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Self-Government Under Industrial Codes

Will industry accept the mandate for self-government conferred by its codes of fair competition or will it allow this power to slip into the hands of a Federal bureaucracy?

PRESIDENT ROOSEVELT'S signature on the code of fair competition for the canning and packing machinery industry on November 1, brings the total of official approvals to 76, 21 of which directly affect the metal-working industry. In a sense these codes are industry's diplomas under the New Deal, and, like university diplomas, they mark the beginning of endeavor rather than the end.

A table on the following page lists the approved metal-working codes together with their minimum wage and maximum hour provisions, their approval date and the deputy administrator who conducted their hearings. Hearings have already been concluded on a number of other codes affecting this field, and their approval is imminent.

The National Industrial Recovery Act has entered the second stage of its existence. The formative period, during which industrial codes were compiled, submitted, revised and approved, has advanced well toward completion. It now remains to make effective the policies and regulations incorporated in these codes.

To put code provisions into practice, a machinery has been set up vested primarily in "code authorities" comprised of representatives of the industrial groups affected and one or more members, non-voting but with veto power, appointed by the Administration. This set-up constitutes a challenge to industry. Will it exercise the opportunity for self-government that was promised and that now has materialized in these code authorities? Or will it, because of real or fancied grievances, fall into a disgruntled lethargy, passively resisting full enforcement of the code provisions?

The folly of this latter course cannot be denounced too vigorously. The Administration has plainly demonstrated that it will make the Recovery Act an actuality. Industry now has its opportunity to cooperate and so to keep control in its own hands. Failure to do its own policing will lead inevitably to domination by a government bureaucracy.

Perhaps the initial machinery for Federal regulation would be set up wisely and manned by individuals conversant with industry's problems and in sympathy with its objectives. But, if past experience is any criterion, sooner or later politics would influence the bureaucratic personnel, and industry would find its problems magnified a thousandfold with their solution more remote than ever.

The proposal made by Gerard Swope to invest the administrative powers of the NRA in a super trade body clarifies the issue. It provides a concrete plan for self-government that would forestall the very real threat of permanent federal control. The details may need revision but the proposal is sound in principle; it should form a rallying point for those who believe that industry still has leaders intelligent enough and forward looking enough to conduct its own affairs.

Those representatives of industrial groups who have been in close touch with General Johnson's staff have gained a keen appreciation of the opportunities for their industries in the codes of fair competition they have helped to formulate. They see in the codes the possibility of eliminating many of the destructive trade practices that have harassed their businesses for years and with devastating results during the recent period of depression. These men are not confused by the more transient phases of the NRA procedure, such as the Blue Eagle drive and the "Buy Now" campaign. They realize that the Recovery Act was designed expressly for industry and appreciate the code provisions that will be helpful to industry. It is those who have remained aloof, critical of both their own representatives and the Administration, who are most apprehensive. It is for those familiar with the benefits of codification to convince and to restore confidence to their doubting brothers.

It is the purpose of this article and others to follow to examine some of the codes of fair competition for the metal-working industry that have been given the force of federal statute by the President's signature. It is not the intention to revive controversial questions regarding hours and wage rates already fixed in these codes, to continue the long discussion as to the merits of the collective bargaining clause made mandatory in each code by Section 7a of the Act, nor to do more than mention those provisions, such as the elimination of child labor, which are generally recognized as being beneficial. Rather it is planned to analyze those provisions in which indus-

try will find its charter for self-government and self-improvement and to point out, where possible, how these provisions may best be utilized.

One of the first metal-working codes to receive official sanction was that for the electrical manufacturing industry, signed by the President on August 4. Sponsored by the National Electrical Manufacturers Association, this instrument provides that each employer shall file with the executive committee a balance sheet at least once each year and also such statistics as may be prescribed regarding plant capacity, volume of production, sales in units and dollars, orders received, unfilled orders, stocks on hand, inventory, number of employees, wage rates, hours of work and other information that may be required. While detailed figures for individual concerns will be kept confidential, these data on the industry will provide a picture of its status that has not been heretofore available.

There are not a few executives who resent this type of "prying into their affairs." They consider the compulsory submission of this information as an infringement of their rights as executives of private enterprise. But in adopting this viewpoint they become blinded to the good that will accrue to their companies and their industry through more comprehensive statistics.

Part at least of our present economic predicament finds its source in an unwarranted optimism that led to uncontrolled expansion. Securities were issued and plants were built without a thoroughgoing analysis of the markets they were to serve. Exact knowledge, while not preventing errors in judgment, will at least provide a factual basis upon which sound judgment may be based.

Approved Codes in the Metal-Working Industry

Code Sponsor	Maximum Hours	Minimum Wages	Deputy Administrator	Approval Date
National Council of American Shipbuilders; N. Y. & N. J. Dry Dock Association	36 32 on governm't work	35c South, 45c North; learners excepted; 80% of minimum for casual labor	Davis	July 26
National Electrical Manufacturers Association	36 shop 40 office	40c unless less was paid July 15, 1929, but not less than 32c. Learners 80% of minimum. Office workers $15.	Muir	Aug. 4
American Iron & Steel Institute	40	25 to 40c based on sectional schedule.	Simpson	Aug. 19
National Automobile Chamber of Commerce	36 average 48 max. 40 office	40c an hour in cities under 250,000 to 43c in cities over 500,000. Office workers $14 to $15.	Lea	Aug. 26
Cast Iron Soil Pipe Association	27 shop 40 office	32c South, 40c North.	King	Sept. 7
American Oil Burner Association	32 to 40 dependent on season	45c; office workers $15.	Paddock	Oct. 3
Gasoline Pump Manufacturers Association	40	40c and provision to maintain difference by which existing rates exceed minimum.	Paddock	Sept. 18
Association of Knitting Machine Manufacturers; Braiding and Wire Covering Machine Manufacturers	40	40c an hour. Adjustment of other wages; office employees $14; learners 80% of minimum.	Muir	Oct. 3
National Association of Farm Equipment Manufacturers	40	Three zones: 30, 35 and 40c an hour. $12 to $15 for office workers. Reductions barred.	Lea	Oct. 3
Laundry and Dry Cleaning Machinery Manufacturers Association	36 shop 40 office	40c an hour; 32c for casual workers or learners $14 for office workers; prohibits reclassification to prevent increase.	Muir	Oct. 3
National Association of Textile Machinery Manufacturers	40	35c an hour; outside helpers and learners south of Potomac 30c. Office workers $14.	Muir	Oct. 3
American Boiler Manufacturers Association	40	34c South; 40c elsewhere. Old workers and learners 80% of minimum. Office workers $15.	Muir	Oct. 3
National Automatic Sprinkler Association	40	40c an hour for manufacturing; 37½c for construction, south; 43¾c North; common labor 80% of minimum. Office workers $14 to $15 except office boys.	Muir	Oct. 9
Compressed Air Institute	40	40c an hour unless lower on July 15, 1929, but not below 35c. Others $15, excepting office boys.	Muir	Oct. 11
Heat Exchange Institute	40	do.	Muir	Oct. 11
Hydraulic Institute	40	do.	Muir	Oct. 11
Steel Heating Boiler Institute	40	35c North; 30c South.	Muir	Oct. 23
National Supply and Machinery Distributors Association; Southern Supply and Machinery Distributors Association	40 to 48 depending on business hours	$10 to $14 weekly depending on population, hours of work and geographical location	Muir	Oct. 24
Association of Gas Cock Manufacturers	40	40c; except for boys and girls on light repetitive work at 33c.	King	Oct. 31
Packaging Machinery Manufacturers Institute	40	40c shop; office workers $14 to $15.	Muir	Oct. 31
The Road Machinery Manufacturers Association	40; with 44 for limited periods	40c; office employees $12 to $15.	Muir	Oct. 31
Canning and Packing Machinery Institute	40	40c shop; learners, 32c; office workers $15.	Muir	Nov. 1

Another provision of the NEMA code requires that every employer shall have an accounting system which conforms in principle at least to the method set up in the manual prepared by the Association. Since Article IX of the code specifies that no manufacturer shall sell below cost, the necessity of uniform accounting is obvious.

Cost Standardization Difficult

Anyone who has heard a group of accountants discuss the pros and cons of their pet methods of cost keeping will realize that uniformity will not be easy to attain. Accounting systems are usually the result of evolution within a given concern. Their revision entails trouble and expense. However, the difficulties in the way of conforming to a standard are not insurmountable if a willingness exists to scrap individual methods to conform to the general plan.

In order to avoid the below-cost provision from becoming burdensome, the NEMA code specifically excepts "dropped lines, seconds, or inventories that must be converted into cash to meet emergency needs." These may be disposed of under conditions approved by the code authority. Also selling below cost to meet competition of an article, equivalent in design and quality, may be permitted if provision is made for it in a supplementary code.

The purpose of the below-cost clause is the elimination of what is now commonly known as "chiseling." In frantic endeavors to keep overhead down and their employees at work, manufacturers have progressively underbid each other until the price structure in their field has been undermined. The evil effects have been magnified by purchasers who, in an attempt to keep down their own costs, have pitted one supplier against another, sometimes openly and sometimes by methods beyond the bounds of ethics. Few industries, if any, have escaped the inroads of the chiseler; and they have found that efforts to meet his demands lead only to self-destruction. If this one evil can be overcome, the Act will have been worthwhile.

On products commonly sold by printed price lists, the NEMA code requires filing with the code authority these lists together with their discount sheets. If prices are to be revised, the new lists must be submitted ten days prior to the effective date. Those companies not using price lists on products where their use is generally recognized may be required to compile and file them. And further, no concern may sell at prices lower or on terms more favorable than those it has specified.

This mechanism strengthens the price structure on standard products even more directly than the general provision outlawing sales below cost. Each company sets a definite scale from which it may not depart except by a general revision. In this form of regulation lies one of the most effective methods for curtailing destructive price-cutting.

Recognizing the wide diversity of companies in its fold, NEMA provides in its code that smaller groups having common problems will be organized in product classifications. These subdivisions will each have their own supervising agency. They will endeavor to correct undesirable practices that are prevalent in their particular branch of electrical manufacturing and, if necessary, file supplementary codes for this purpose. In this way NEMA provides the flexibility needed to self-govern so wide and diverse a field.

The Automobile Code

Another code receiving early approval (August 26) was that for the automobile manufacturing industry. Since the product is sold to the consumer through dealers according to a fixed list price, pricing provisions such as those adopted by NEMA do not apply. The ethics of merchandising for the industry are incorporated in the dealer's code as a separate instrument.

The automobile code, sponsored by the National Automobile Chamber of Commerce, however, does specify that statistical reports be made to that body. It is commonly believed that this requirement had much to do with the failure of the Ford Motor Company formally to accept the code.

Unique in the automobile code is the paragraph that is now widely known as the merit clause. This provides that employers "may exercise their right to select, retain, or advance employees on the basis of individual merit, without regard to their membership or non-membership in any organization." This paragraph was placed immediately following the collective bargaining clause. The industry had long resisted outside efforts to organize its employees and had obviously inserted this clause to insure the right of its workers to remain independent of any outside labor organization.

Pending and after approval of the code, leaders of organized labor protested vehemently. General Johnson declared that the clause had "slipped through" and that the collective bargaining as defined by Section 7 (a) of the Act needed no qualification. However, he did submit further codes to the President containing comparable clauses. In every case they were stricken out by the executive order accepting the code.

Finally what seemed to be a deadlock, and a somewhat futile one at that, was broken by a letter from the President to General Johnson as follows:

"Because it is evident that the insertion of any interpretation of Section 7 (a) in a Code of Fair Competition leads only to further controversy and confusion, no such interpretation should be incorporated in any code. While there is nothing in the provisions of Section 7 (a) to interfere with the bona fide exercise of the right of an employer to select, retain, or advance employees on the basis of individual merit, Section 7 (a) does clearly prohibit the pretended exercise of this right by an employer simply as a device for compelling employees to refrain from exercising the rights of self-organization, designation of representatives and collective bargaining which are guaranteed to all employees in said Section 7 (a)."

Thus the "merit" clause was killed, and its provisions simultaneously recognized. To date this letter appears to have satisfied the demands of employer and employee groups and will release many codes previously held up on this point.

Shipbuilding

Arbitration of old contracts under a clause borrowed from the cotton textile code is provided in the shipbuilding code. The purpose of this provision is to avoid hardship on shipbuilders who had made contracts at lower wage rates and who would therefore suffer losses under the code rates. The wording of this clause is not mandatory but reads "it is equitable and promotive of the purposes of the Act that appropriate adjustments of such contracts to reflect such increased costs be arrived at by arbitral proceedings . . ."

The shipbuilding code also prohibits the sale of products or services below reasonable cost. It does not provide a cost manual but defines cost as "the cost of labor plus the cost of materials plus an adequate amount of overhead including an amount for the use of any plant facilities as determined by cost accounting methods recognized in the industry (and approved by the Committee constituted for the enforcement of this Code)." Rebates, refunds, allowances, measured discounts and special services and the receipting of bills for insurance work until payment is made are all outlawed by the code.

Actual experiences in applying the regulations in the more important codes for the metal-working industry will be detailed in subsequent articles. Such experiences should certainly be helpful to readers who are still wondering what they are going to be up against, and what to do about it.

Precision Work on Refrigerator Parts—II

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Editor, American Machinist

Examples of boring, grinding and honing show the use of modern tool equipment and close attention to the design of holding fixtures

ANOTHER method of finishing hardened steel compressor cylinders is by the use of a Bryant machine, as seen in Fig. 14: Fig. 12 shows a finished cylinder. A previous operation has ground a $\frac{3}{8}$-in. dowel hole in a small machine. This removes 0.003 in. of stock to a tolerance of 0.0003 in. at the rate of 30 per hr. The second operation is to grind the central bore, $1\frac{1}{2}$x$1\frac{1}{4}$ in., and finish the face, which is 3 in. in diameter. Fig. 13 shows a similar job set up in a machine.

Locating from the ground dowel hole the piece is held in a draw chuck as in Fig. 14. This chuck is shown in detail in Fig. 15. The hole is ground by one spindle as at *A*, after which the larger cup wheel comes into play as at *B*. Finishing the hole requires the removal

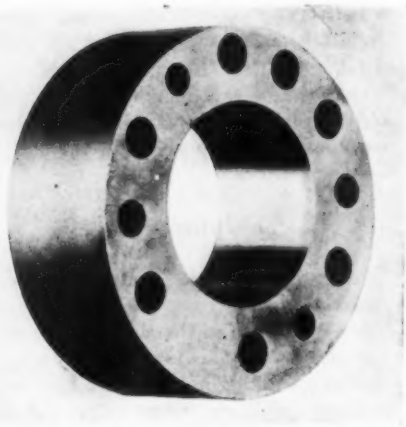


Fig. 12—A finished cylinder of steel, hardened and ground. It is located from a previously ground dowel hole

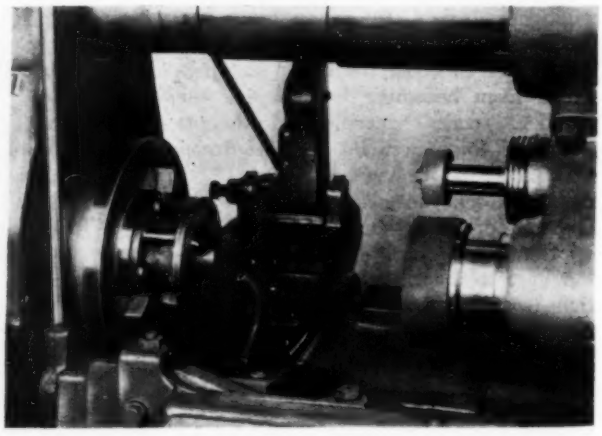
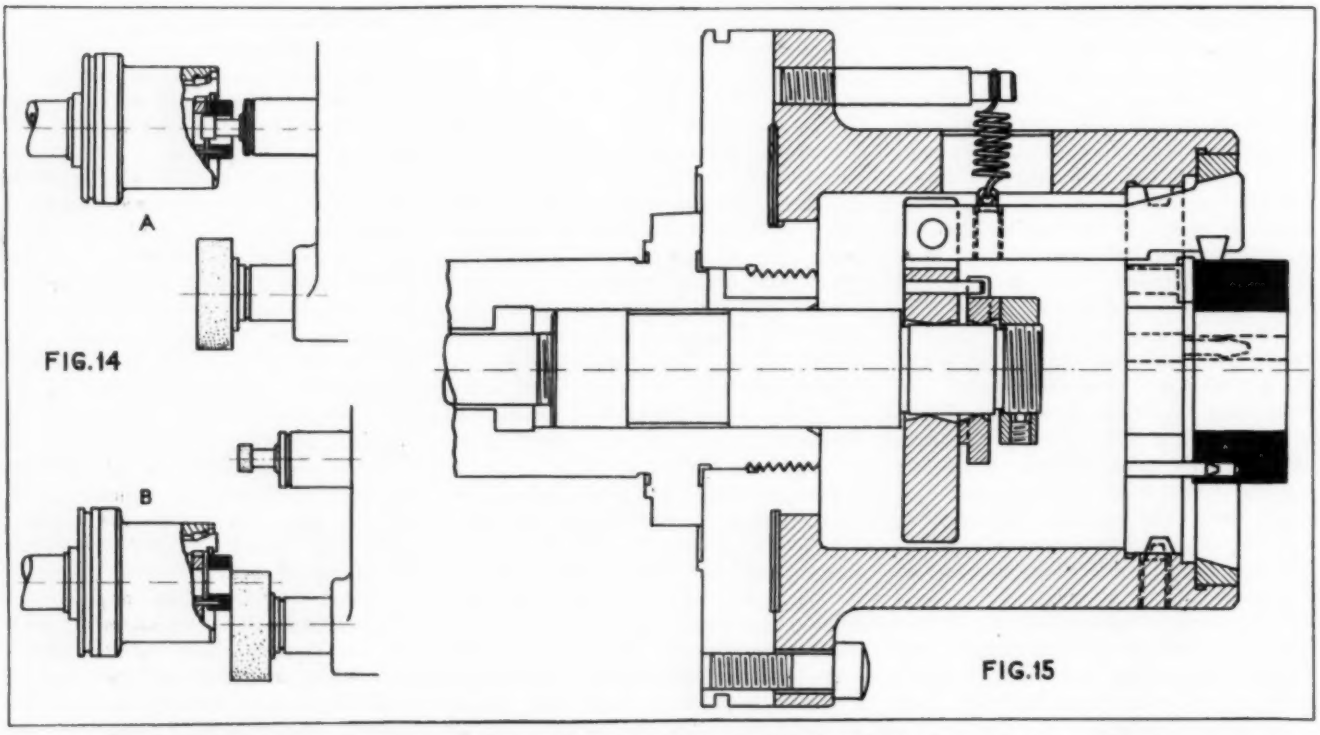
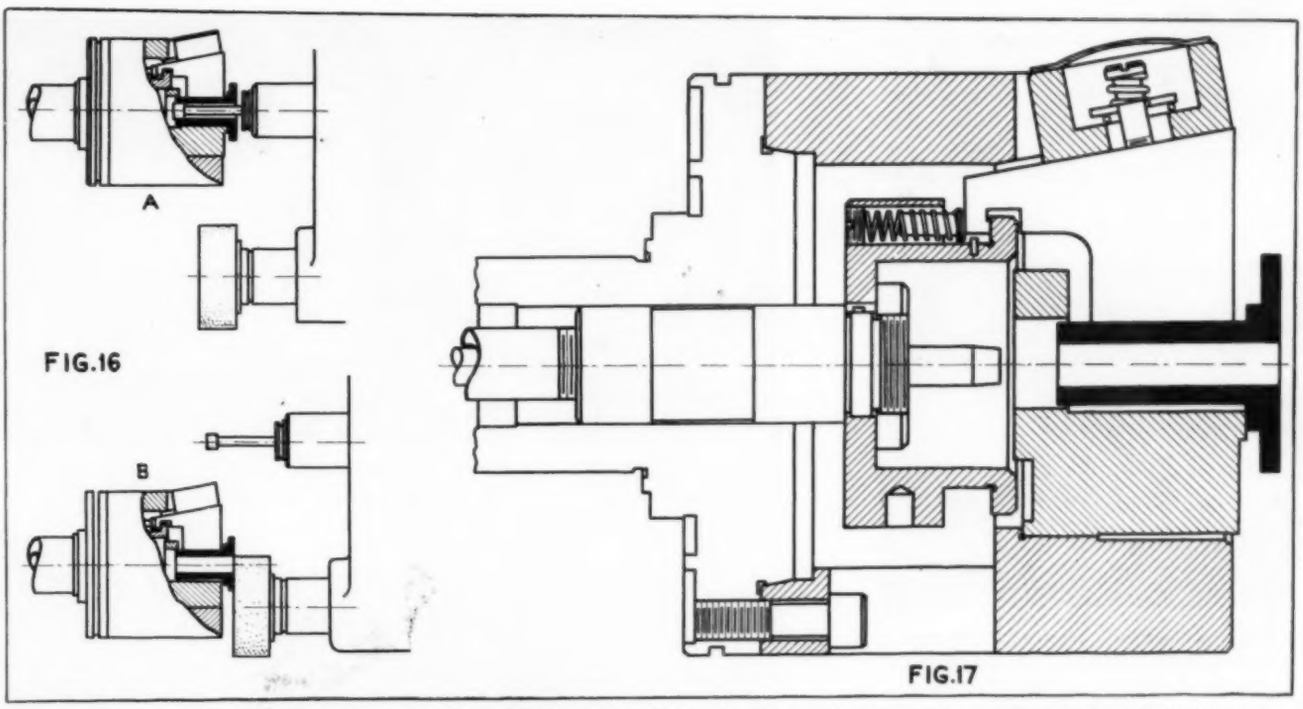


Fig. 13—The set-up used on a Bryant machine for grinding both the central hole and the outer face at one setting



Figs. 14 and 15—Showing how the hole is ground by one spindle and the face by the cup wheel, also details of the chuck or holding fixture and the dowel pin which locates the work



Figs. 16 and 17—A similar layout for the hardened steel bearing plate, showing how the two spindles of the Bryant grinder operate. The work is held in by the special collet chuck which is shown in detail

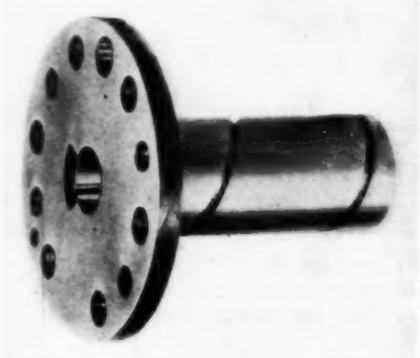


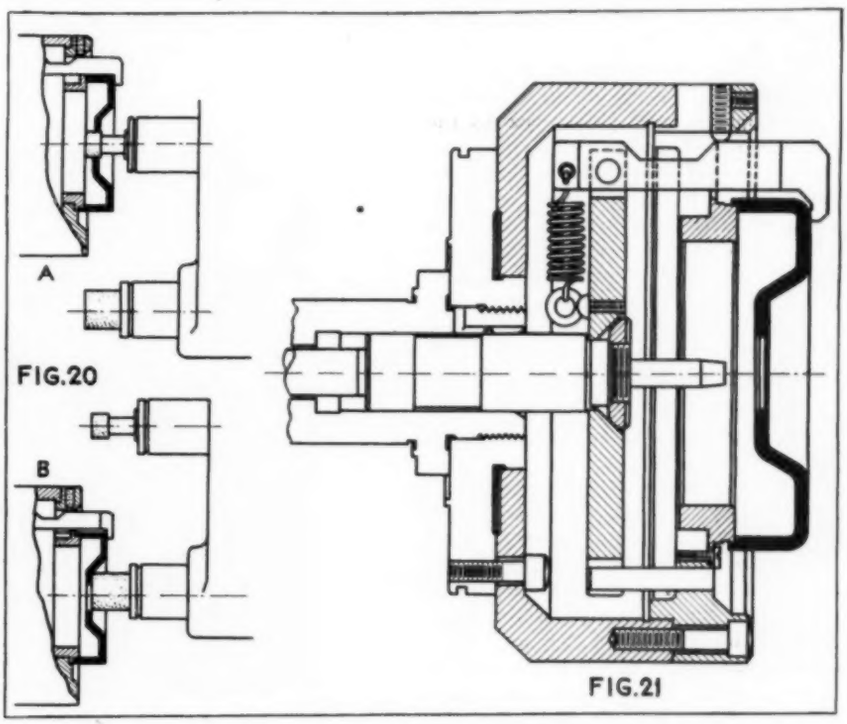
Fig. 18—The hardened steel bearing plate which is finished all over and ground on all important surfaces

Fig. 19—Malleable-iron cast spider which is ground only in the bore and on the adjacent face

of 0.010 in. of stock while the face is cleaned up perfectly square, at the rate of 20 pieces per hour. The hole tolerance is 0.0003 in.

The hardened steel bearing plate Fig. 18 fits at the end of Fig. 12. The hole is $\frac{5}{8}$x3 in. with a 3-in. flange. With 0.006 in. of stock left for grinding the production rate is 20 per hr. The hole tolerance is 0.0004 in. The face of both cylinder and bearing plate must be gas tight when bolted metal to metal. The grinding positions of the two wheels are shown at *A* and *B* in Fig. 16. Details of the draw-in chuck used for holding this piece are shown in Fig. 17.

A somewhat different piece, the field spider, is shown in Fig. 19. It is held



Figs. 20 and 21—Another layout of a malleable casting which shows both spindle positions and the type of chuck used

in the draw-in chuck shown in detail in Fig. 21. This is of malleable iron and is only ground in the hole and on the recessed face, as indicated by the wheel positions in Fig. 20. The hole is 1¼ in. in diameter, the faced surface being 3 in. The O.D. is 7 in. About 0.010 in. is removed from the bore, the tolerance being 0.0003 in. There is no special tolerance on the face, but it must be a good finish. Production is 30 per hr.

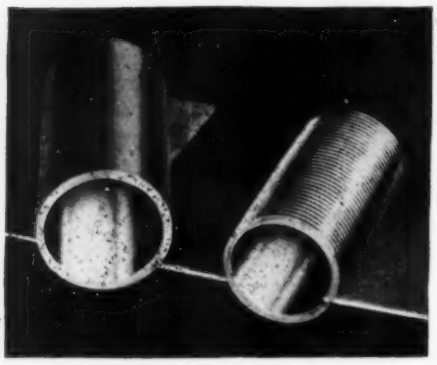
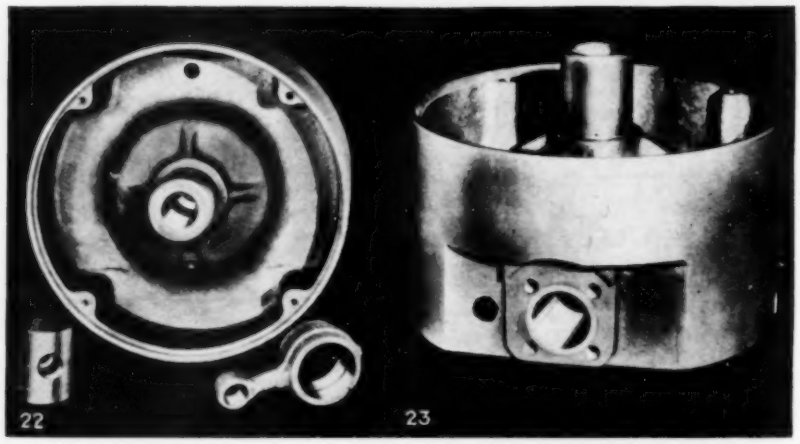


Fig. 24—Two bronze bushings bored with diamond tools on a Cimatool bench machine to a tolerance of 0.0005.

In Fig. 22 is an iron casting with a bronze bushing pressed in each end of the hole. The piston is also of cast iron while the connecting rod is of bronze. The bushed holes are 0.7513 to 0.7518x3 5/32 in. and are bored at 2,000 r.p.m. with a feed of 0.0015 in. per revolution, making 22 sec. for each bushing. The pin hole in the cast iron piston is 0.4995 to 0.4997x1 3/32 in. and is bored at 2,000 r.p.m. with a feed of 0.005 in. per revolution in 6 sec., for both holes. The small end of the bronze connecting rod is the same size as the pin hole in the piston, while the large bore is 1.1877 to 1.1882x7/8 in. The small end is bored in 12 sec. at 2,400 r.p.m. and the large hole in 36 sec. at 1,500 r.p.m. with a feed of 0.001 in. per revolution. With a double-end machine both are bored at one mounting. The cylinder in the side of the iron casting in Fig. 23 is 1.0312 to 1.316x1¾ in. It is bored in 20 sec. at a speed of 900 r.p.m. and a feed of 0.005 per revolution. These are bored on the Cimatool bench boring machine.

The two bronze bushings in Fig. 24 are also bored on the Cimatool bench boring machine, using diamond tools. The bores are: 1.000x2 7/16 in.; 0.840x2 7/16 in., with a minus tolerance of 0.0005 in. The spindle speed is 3,600 r.p.m. and the feed 0.0015 in. per rev. which gives a production of 185 pieces and 222 pieces per hr. for left and right parts. One operator runs two machines. The machines have hydraulic feed and clamps, making 407 pieces per man hour.



Figs. 22 and 23—An iron casting which is bronze bushed, and two small parts. Both iron and bronze are bored on the Cimatool bench machine

Fig. 25—Group of castings finished on an Ex-Cell-O machine. They include a compressor housing, bronze air valve, seal and an end bell, of bronze. Both carbide and diamond tools are used

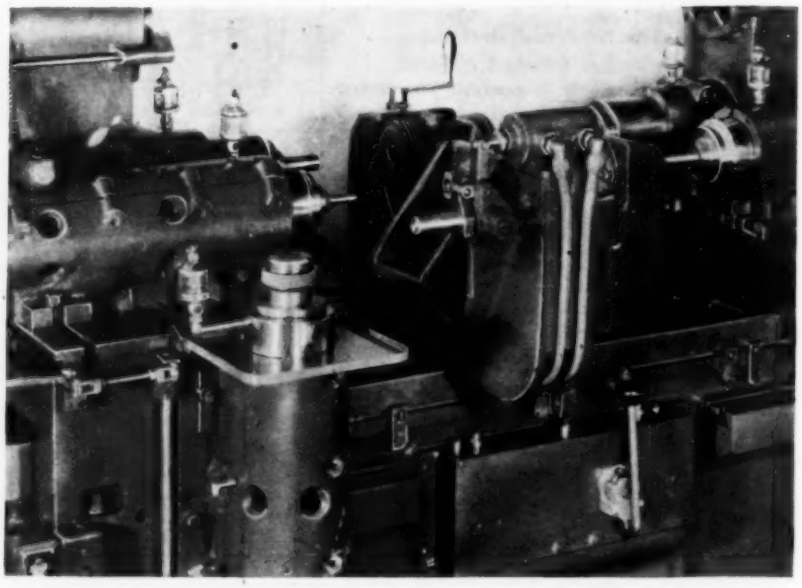


Fig. 26—All the parts shown in Fig. 25 are bored on this machine. Both cylinders are bored at once by opposed spindles. One boring unit has a vertical spindle

Carbide and Diamond Boring

Several compressor units are shown in Fig. 25. These include a cast iron compressor housing; a bronze air valve, a bronze compressor seal; and an end bronze bell for the compressor. These parts are all bored on the Ex-Cell-O machine in Fig. 26. The compressor seal is faced at another operation. The metal left for finish boring is 0.010 in. for all parts except the compressor seal which is 0.006 in.

A special fixture holds the housing while the opposed spindles bore both cylinders at once, and in line. These spindles drive the carbide-tipped tools at 1,200 r.p.m. and have a feed of 0.003 in. per revolution. The cylinder bores are 1¼x1¾ in. The cross, or crank bore is bronze bushed and is ¾x⅞ in. For this, and the other bronze bores, a spindle speed of 3,500 r.p.m. is used, with a feed of 0.001 in. per revolution.

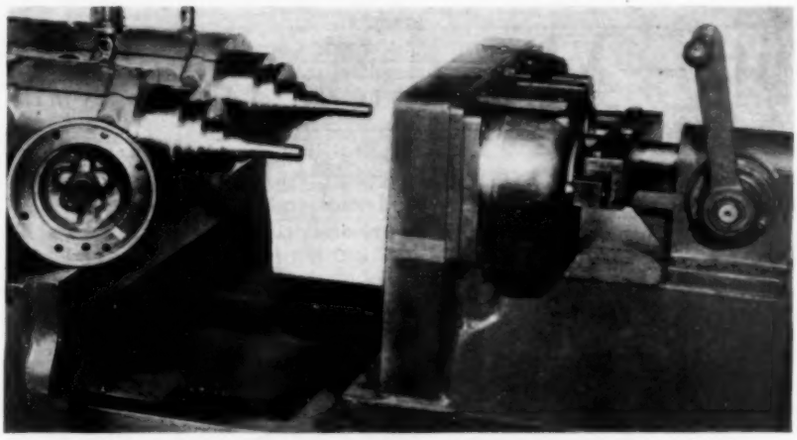


Fig. 27—Here another Ex-Cell-O machine bores the end bells of compressor bodies. Carbide tools are used on the iron parts

Fig. 28—Two small tandem bores of one-half inch are honed on a Hutto machine as indicated here.

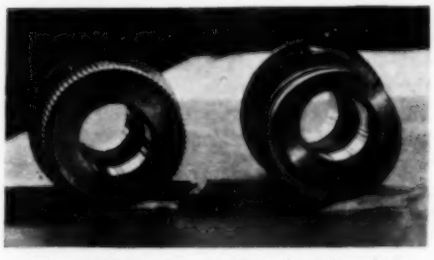


Fig. 29—This shows inside the bores, which are in each end of a 3½ in. piece

Other fixtures hold the remaining parts in position for boring. At the front and to the left of Fig. 26 is the air valve. The bronze bushing is bored by an in-built-motor boring unit. The bronze compressor seal is mounted in a quill-type chuck and driven directly by the boring unit which is mounted in a vertical position at the front of the machine. The boring bar for this operation is mounted in a special support at the front of the fixture table. As the table reaches the end of its stroke on the left a hydraulic cylinder lowers the facing tool so that the bronze seal is faced as the table moves to the center.

Cylinder bores are made at the rate of 32 per hr. with 87 crank bores in the same period; compressor end bells—90 pieces; air valves—85 pieces and the compressor seal—120 pieces per hour. These production times are based on an efficiency of 85 per cent. Carbide-tipped tools are used for the cast iron bores and diamond tools for the bronze.

Another Ex-Cell-O job is seen in Fig. 27 where compressor bodies and end bells are being bored to $\frac{13}{16}$x1¼ in. removing from 0.008 to 0.010 in. of cast iron at 1,750 r.p.m. and a feed of 0.0015 in. The parts are located by means of a circular dowel and squared against the dowel face. Tungsten-carbide tools are used and one operation bores 115 pieces per hour.

A bronze seal ring is faced with a diamond tool to a greater accuracy than was formerly obtained by facing by ordinary methods and then lapping.

Honing two small bores in tandem is done on a Hutto machine with a dial workholder, part of which is seen in Fig. 28. The diameter is ½ in. and the length ⅝ in. but one bearing is at each end of a 3½-in. piece as in Fig. 29. Only 0.0003 to 0.0005 in. of metal is removed and the production is in excess of 60 pieces per hour with a single spindle. While the tolerance is 0.0003 in. for alignment and roundness the work comes off the machine with much less variation than this.

The hone runs at 300 r.p.m. and has 140 reciprocations, these being approximate figures in both cases.

Suggestions from the Men

JOHN E. HYLER

Most men working in a factory, when an idea for improvement comes to them, will usually report it to their superior. At least, that is the normal course they pursue the first time. Thereafter, everything depends upon how the idea has been received. It is a time calling for the exercise of much tact on the part of the foreman.

If the idea seems worth while, particular care should be taken to see that the man gets full credit for it. That does not necessarily mean an immediate financial reward, but merely that some sort of appreciation be shown by word or manner. It is especially tactful to let the man discover that he has been reported in as the originator of the idea—he will seldom fail to follow the same path with other ideas that come to him.

If an idea for any reason does not impress the foreman as being practical or useful, it is a point in tactful practice not to state the fact immediately. Suppose an apprentice has a hare-brained notion that seems quite wonderful to him. Never laugh at him or ridicule him. Go into the idea in a studious manner, with all gravity, as though you were handling something worth a million dollars, for his future loyalty is at stake. Approach the sore spot with care, and ask him just how he would overcome this difficulty, or perhaps say "you are a little bit afraid that this particular thing would be hard to overcome." Ninety-nine times out of a hundred you will save his face. And the hundredth time, possibly, he will come right back at you with a really practical answer. In that case, you shall have saved your own.

Cost Finding to Assure Profits—VI

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Departmental analysis and unitization of costs are covered with some unique suggestions for control

THE IMMEDIATE control features of uniform cost-finding methods are vested in the labor, productive material, variable expense and fixed expense digests, which have been discussed in previous articles. These digests also permit the direct correction of actual values to unit values and the establishment of the profits and losses sustained thereby.

The labor digest is also the means for relieving the payroll account to the goods-in-process and the expense accounts while the productive material digest is the record used for relieving the productive material inventory to the goods-in-process account. While it is proper to charge productive labor and material direct to goods-in-process through the digests, expense costs require an intermediate step because of cross charges which usually occur between the manufacturing and distribution expense departments. For this reason, all expense charges are collected accounting-wise in their proper expense accounts, corrected to unit values, and the cross charges are calculated and made. Then the manufacturing expense is closed into goods-in-process, and the distribution expense becomes the complete selling cost for the period.

Analysis by Departments

While the expense costs are in this intermediate phase, they should be both integrated and analyzed by departments, for comparative cost purposes, in order to reflect the individual profit and loss for each department in total, as well as by classification of expense. Only so can the combined effect of the control instigated by the various digests be visualized.

On the departmental analysis (Fig. 9), the departmental costs are coordinated by cost periods. Here, regularly, the expense costs, both actual and unit, are tabulated, the production data recorded, the inter-department charges calculated and posted, and the departmental profit or loss determined. Also, this record may properly include the direct labor costs, detailed production data, comparative actual unit costs and other pertinent departmental cost facts.

The departmental analysis, which is ordinarily set up as a continuous record for monthly or cost period comparisons, is thus a permanent record of departmental expense cost, experience and activities in particular, and a departmental direct labor and production data record in general. It is the proper place in which to revise, adjust and recalculate expense unit values.

Sources of Data

The sources for postings to the departmental analysis are the labor digest, the variable expense digest and fixed expense digest. The digest data is, of course, in total by major expense classifications and is so carried into the departmental analysis. Provision should be made in the departmental analysis for each department for sufficient subdivisions of expense under each major classification so that a detailed analysis of expense may be methodically recorded whenever desired. Such a detailed analysis is usually required only when the actual and unit expense costs exceed the allowed tolerances.

The departmental analysis is usually classified into three major groups:

1. Non-productive departments—those departments whose expense costs are meted to other departments, both manufacturing and distribution, according to the amount of service rendered. The costs of non-productive departments do not enter directly into the cost of the product.

2. Productive departments — those manufacturing departments whose unit expense costs are charged directly to the cost of the product.

3. Distribution departments — those departments which have no part in the production cost of goods, but whose expenses are incurred strictly in the selling and distributing of the product.

Practice and convenience dictate that both the non-productive and the productive departments be treated together as manufacturing expense and the distribution departments as selling expense, for expense definition purposes. In the larger businesses it may be advisable at times to set up a separate account in the ledger for the non-productive department expense in order to keep it apart from the other two major classifications and so avoid any chance of confusion. This, however, is not usually necessary.

Generally the greater portion of the non-productive department expense is meted to the productive departments and the smaller portion to the distribution departments. "Charge backs" from the distribution departments to the manufacturing departments seldom occur. In the end the non-productive unit costs are charged out to the productive and distribution departments.

Usual Order Reversed

After the postings to the departmental analysis have been made from the various digests and totaled as to "Total Controlled Expense" and when productions or units earned have been posted to the productive and distribution departments, the departmental analysis is ready for final expense calculation.

The usual practice in the past was to make the non-productive actual department calculations first and then mete out the proportionate actual charges to the other departments. The method being described reverses the order of calculations. The productive, distribution and other departments' usage of the non-productive services are calculated first. These are the units earned for the non-productive departments and are therefore posted back to the non-productive department responsible for the specific service.

YEAR ____ DEPARTMENTAL ANALYSIS

	4 HEAT, LIGHT & POWER	UNIT VALUE	1ST COST PERIOD ACTUAL AMT.	UNIT AMT.	P & L	
	NON-CHARGEABLE LABOR					
	SUPERVISION					
	FIREMEN AND ENGINEERS					
	GENERAL HELP					
	REPAIR AND MAINTENANCE					
	TOTAL	24	801 96	936 00	134 04	
	VARIABLE EXPENSE					
	FUEL					
	WATER					
	LUBRICANTS					
	MAINTENANCE MATERIALS					
	REPAIR MATERIALS					
	TOOLS AND SUPPLIES					
	SUNDRY					
	TOTAL	57	2044 08	2223 00	178 92	
	TOTAL CONTROLLED EXPENSE		2846 04	3159 00	312 96	
	FIXED (CHARGES) EXPENSE	.17	663 00	663 00	—	
	CHARGES FROM OTHER DEPTS.					
5	REPAIR & MAINTENANCE EXPENSE	.02	78 00	78 00	—	
	TOTAL DEPARTMENT EXPENSE	1.00	3587 04	3900 00	312 96	
	UNITS EARNED					
1	ADMINISTRATIVE			24 00		
2	GENERAL OFFICE			79 80		
3	GENERAL FACTORY			180 00		
5	GENERAL REPAIR AND MAINTENANCE			105 00		
6	EXPERIMENTAL AND RESEARCH			33 60		
8	RECEIVING, STORAGE AND SHIPPING			122 00		
9	TOOL MAKING, REPAIR AND MAINTENANCE			50 00		
11				270 00		
16				136 40		
27				425 00		
28				532 00		
29				300 00		
	TOTAL MANUFACTURING			3925 40		
41	GENERAL SALES			25 20		
43	SALES STAFF			29 40		
47	WAREHOUSING, SHIPPING AND FREIGHT			20 00		
	TOTAL DISTRIBUTION			74 60		
	TOTAL UNITS EARNED			3700 00		

YEAR ____ DEPARTMENTAL ANALYSIS

	25 LIGHT FABRICATING	UNIT VALUE	1ST COST PERIOD ACTUAL AMT.	UNIT AMT.	P & L	
	INDIRECT LABOR					
	SUPERVISION					
	ASSISTANTS AND CLERKS					
	HANDLERS AND TRUCKERS					
	GENERAL HELP					
	TOOL AND MACHINE SETTING					
	DIE REPAIR AND MAINTENANCE					
	REPAIR AND MAINTENANCE					
	ALLOWANCES ON DIRECT LABOR					
	TOTAL	.34	2602 23	2482 00	(120 23)	
	VARIABLE EXPENSE					
	LUBRICANTS					
	MAINTENANCE MATERIALS					
	REPAIR MATERIALS					
	DIE REPAIR MATERIALS					
	TOOLS AND SUPPLIES					
	ABRASIVES AND WHEELS					
	GAS AND OXYGEN					
	OUTSIDE DIE REPAIRS					
	WASTE					
	SUNDRY					
	TOTAL	.36	2544 92	2628 00	83 08	
	TOTAL CONTROLLED EXPENSE		5146 55	5110 00	(36 55)	
	FIXED (CHARGES) EXPENSE	.32	2336 00	2336 00	—	
	CHARGES FROM OTHER DEPTS.					
3	GENERAL FACTORY	.24	1752 00	1752 00	—	
4	HEAT, LIGHT AND POWER	.09	657 00	657 00	—	
5	GENERAL REPAIR AND MAINTENANCE	.03	219 00	219 00	—	
9	TOOL MAKING, REPAIR AND MAINTENANCE	.12	876 00	876 00	—	
	TOTAL DEPARTMENT EXPENSE	1.50	10986 55	10950 00	(36 55)	
	DIRECT LABOR	1.00	5979 91	7300 00	1320 09	
	TOTAL DEPT. ADDED VALUE	2.50	16966 46	18250 00	1283 54	
	UNITS EARNED			7300		
	UNIT VALUE VARIATIONS		TOLERANCE	%		
	INDIRECT LABOR		± 5.0	− 4.8		
	VARIABLE EXPENSE		± 4.0	+ 3.2		
	DIRECT LABOR		± 5.0	+ 18.1	*	

① ② ③ ④ ⑤ ⑥

Fig. 9—Serving as a departmental expense and direct labor cost-comparing medium, the departmental analysis may be used to advantage by cost and estimating departments, foremen, supervisors and executives

For example, in Department 25 (Fig. 9), heat, light and power usage is calculated under the heading "Charges from Other Departments" on the basis of a predetermined value per unit of production. The calculated amount is entered on the Department 25 departmental analysis record and then posted as the units earned on the Department 4 heat, light and power departmental analysis record. The sum of such postings on the Department 4 record becomes the "Total Units Earned" for Department 4.

This way of treating charges for services from other departments is unique to this cost-finding method. It avoids duplication in posting various production figures, calculating time is reduced, and opportunities for errors are minimized.

Fixed Expense

The fixed expense calculations and postings are treated similarly to "Charges from Other Departments" except that the "Unit Value Amount" earned postings are made to the fixed expense digest rather than to a departmental analysis record.

The fixed expense and charges from other departments are not subject to control in the departments to which they are charged. They must be controlled at the source, which, for the charges from other departments, means in the departments in which the charges originate.

Thus, it is evident that charges subsequent to the total controlled expense will always vary directly with the units earned and the postings will be the same for both actual and unit amounts. In practice it is not necessary to enter such charges in both the actual and unit columns. It is sufficient to enter them in the unit amount column only, but to use them in totalling both actual and unit amount columns to obtain the "Total Department" figures.

Now the total controlled expense is added to the fixed expense and charges from other departments to produce the "Total Department Expense." These are the final expense figures for the department. They are of little value for expense control purposes, but they have other essential uses.

Non-Productive Expense

For non-productive departments the actual total department expense serves as a guide in establishing and revising non-productive expense unit values. The unit total department expense is the amount to be charged to other departments for the service rendered. By so doing only the allowed amount is charged to other departments for non-productive services. The variations from unit values have already been adjusted.

Productive Department Expense

For productive departments the actual total department expense serves as a guide in establishing and revising productive expense unit values. The unit total department expense is the amount of manufacturing expense to be charged, through the departmental profit and loss summary—which will be discussed in the next article—to the goods-in-process inventory account. By so doing only the allowed amount of manufacturing expense is charged to goods-in-process. The variations from unit values have already been adjusted into the proper manufacturing profit and loss accounts.

For distribution departments the actual total department expense serves as a guide in the establishing and revising of distribution expense unit values. The unit total department expense is the amount of distribution expense to be applied against the sales for a cost period in determining the merchandising

profit and loss. The variations from unit values have already been adjusted into the proper distribution profit and loss accounts.

To complete the manufacturing departmental analysis calculations, it is necessary to add the direct labor to the total department expense to produce the "Total Department Added Value," which is the total operating cost of the department. The difference between the actual and unit amount is the total operating profit or loss for the department. The unit total department amount is later posted to the departmental profit and loss summary. Individually and collectively such figures serve as an over-all or bulk indication of the coordinated activity of the manufacturing departments.

Unitization of Costs

It is now time to indicate the actual development of the labor and expense units which have been referred to throughout these articles.

Proper unitization is essential to modern, intelligent and readily understandable cost portrayal. The use of units permits cost comparisons on a uniform basis, the establishment of profits and losses by elements of cost and by departments and the calculation of reliable product costs with a minimum of time and effort. Product costs on a unit basis are determined in sufficient detail and in such a way that each pertinent cost factor stands by itself and is easily recognized. Improper applications of cost factors to a product are eliminated.

The first step in defining and establishing cost units is to develop all labor, material, expense and production costs and data on a current and actual basis. These facts will serve as a guide in the unitization determination and will assure that every necessary detail is included. Too often unitization is attempted on a theoretical basis, without reference to actual conditions and practice in a given business, with the result that important factors of cost are disregarded and individual peculiarities of the business, which influence costs, are overlooked.

With the current cost facts at hand, or in the making, the labor unitization problem ordinarily receives initial consideration. In practice it is usual to carry on the factual analysis and theoretical groundwork simultaneously.

A plant operating on week work and day work requires much more detailed study than one in which a sound and modern wage incentive method is already in use. The first generally requires a complete labor study and the assimilation of a modern wage incentive installation, if not an actual installation, in order to define labor units and labor unit values. Of course, such an installation is always highly desirable in order to assure that the concern will continuously get value received for its labor dollar.

If modern and equitable wage incentive methods are in use, and the labor studies on which the incentive is based are reliable, the establishment of labor units and unit values is comparatively simple.

Units Based on Piece Rates

Assume that a reliable wage payment plan exists and that the labor time and skill requirements are known. For productive labor the problem then is to select a term which will serve as a common denominator for all production of a given department. Next, calculations are made to relate all items of current production to this term, which is the productive labor unit. Of course in establishing this unit a reasonable amount is included for allowances and other expected variations.

For example, in a given department the production multiplied by the piecework rates for several cost periods totaled $38,000. During the same time the allowances and other expected variations after the elimination of wholly unnecessary and extraordinary errors amounted to $2,000. The total direct labor amounted to the sum of these two, or $40,000. Taking one dollar as a convenient and reasonable unit value, the total labor units earned over the several cost periods under consideration would be 40,000.

In this instance, ninety-five cents of the one dollar direct labor unit value, represents the actual piecework value of direct labor per unit and five cents represents the amount considered adequate for allowance and other expected variations per direct labor unit. Therefore, in computing the allowable direct labor units for a given product, it is only necessary in this instance to divide the actual piecework rate by 0.95. It has been found more generally satisfactory to use one dollar to represent the aggregate unit value rather than the piecework portion only of the unit value. By so doing all direct labor calculations subsequent to the single calculation of individual product cost are simplified, as they involve only the multiplication of the units by one dollar.

In plants or departments producing small articles whose labor cost is generally fractional, it is usually advisable to set up the dollar as representing 100 or even 1,000 labor units, in order to eliminate the necessity of carrying out product cost figures to an unreasonable number of decimal places.

For the advanced management that has adopted complete unitization of labor costs, including both indirect and direct labor, still another step is necessary. A study must be made to determine the exact relation of the indirect labor to the direct and to the various items or classes of items of production. The indirect labor may enter into the labor unit determination on the basis of a percentage to direct labor or on an individual basis for each item or class of product.

In the example previously cited, the studied indirect labor amounted to $10,000 for the periods considered. It was also decided that the indirect labor bore a constant relation to the direct labor. The total studied labor cost therefore became the sum of the piecework labor, $40,000, and the indirect labor, $10,000, or $50,000. Accepting the previous labor value of one dollar, the units produced for the periods would be 50,000. It will be noted that it was decided to keep the unit value constant for ease in future use for day to day calculations. Because the indirect has been included, this means that more units must be allowed on a given item of product. The total unit labor dollar in this instance now represents seventy-six cents of piecework labor, four cents of labor to cover allowances and other variations and twenty cents of indirect labor. To establish a total labor unit value in this instance for a given product, it is necessary to divide the piecework rate by 0.76, or to multiply by the reciprocal of this figure.

Comparison with Previous Costs

In the development of labor units, or for that matter any other units, it is to be remembered that the actual cost figures must constantly be consulted and any unexplained deviations between calculated units and values and the actual performance must be satisfied before permanently establishing the calculated unit or value.

In Fig. 9, Department 25, is illustrated a labor unitization which covers direct labor only. The unitization of indirect labor in this illustration is carried out in expense. It is this type of set-up that most frequently occurs.

In Column 3 of Fig. 9, Department 25, the unit values are shown. It will be seen that by multiplying labor unit values by the units earned the unit amounts will result, as posted in Column 5. In Column 4 the actual costs are posted and the difference between the actual and unit amount is posted in Column 6, which is the profit and loss. This is as true for expense items as for labor items.

The expense unit development is

somewhat more complicated than that for labor units. The detail figures oscillate considerably and are in no way so tangible. However, if properly set up and supervised they can be controlled within reasonable limits.

First, let us consider the expense unit development for productive departments.

The actual expense cost over several cost periods, when considered together with the rate of activity over these same periods, will indicate the general course to be followed. Assuming a medial rate of activity which may be rightfully expected for a reasonable period ahead, it is practical to temper and adjust the actual expense cost which it is expected will be incurred, at the same time eliminating wholly unnecessary and extraordinary expense errors. This is done for both indirect labor and variable expense. The tempering of the fixed expense for an assumed activity has already been indicated and the charges from other departments are adjusted at the source in the departments in which they originate, since the productive department foreman has no control over them.

At this point the new-found expense includes all expense, both that which it is possible for a productive department foreman actually to control, and those like the department fixed expense and charges from other departments, which are beyond the direct control of the foreman. This total department expense is the reasonable expectancy of expense expenditure for the assumed production.

If it is decided that the expense of a department can be allocated to the product on the same basis as direct labor, the labor units earned may be used as expense units as well. In this instance to establish the value of the expense units it is necessary only to divide the total expense reasonably expected by the expected labor units earned. Fig. 9, Department 25, illustrates a productive department which was developed on this basis.

Separate Expense Allocation

When expense has to be allocated to the product on an individual basis, the problem is somewhat more intricate. Here it is necessary to establish initially, usually by groups of product, the amount of predetermined expense for each product or group item. From this point on, the method of calculating the expense units is the same as that described for direct labor units. It is by no means to be inferred that in this case the labor unit and the expense unit are the same.

For non-productive departments the reasonable expectancy of expense expenditures for an assumed activity is determined in the same way as for the productive departments. Of course, in practice it is necessary to calculate the non-productive first, as the greater portion of the non-productive expense must be allocated to the productive departments before the unitization and unit values can be computed. The reverse order has been chosen for the explanation in this article, as the productive department costs are the backbone of the cost structure.

Hard and fast rules for defining the allocation of non-productive expense to other departments are impossible because of varying conditions in individual businesses. For example, whether or not a business sells its own product will influence the necessity of setting up the allocation of the administrative and general office shares.

Plant Affects Methods

The type of factory will influence the practice in distributing general factory expense, for in some instances it is practical to distribute to other departments on the basis of direct labor. In others total labor may be the more equitable basis, while at times both labor and controllable expense may be the proper allocation basis.

For heat, light and power some plants may be equipped with meters which make the allocation of the costs a simple matter. Where meter installations do not exist, it is advisable and necessary to calculate the rated hp. consumption of such service for the assumed rate of activity and make the initial allocation on this basis.

Arbitrary allocations which, incidentally, have been the general practice, are insufficient and almost invariably warp the cost picture. If reliable expense units are to result, the distribution of the non-productive departments, particularly, must be made on an engineered and studied basis, rather than an arbitrary one.

The foregoing discussion of non-productive departmental expense treats with the actual expense costs in the development of the unit values to be used in finding the unit amount for non-productive services to other departments, which are credited back to the departments rendering the service, as "Units Earned."

Using the actual expense cost over several cost periods, after eliminating wholly unnecessary and extraordinary expense errors and tempering these expense costs by the anticipated rate of activity, the allocations for non-productive charges to other departments are accomplished. Such allocations should be made on the studied basis heretofore advocated. At this point the actual corrected expense costs over several periods stand assigned to the proper departments for the purpose of establishing the unit values for the service rendered to the departments.

There now remains only the simple calculation of dividing various actual expense charges from other departments by the expected expense units earned to establish the unit values in a given department for the various services rendered to it.

By treating non-productive expense charges in this fashion, all department expense costs are charged with costs from other departments on a unit value basis strictly in proportion to the activity in the departments receiving such service. Variations in non-productive expense costs beyond the control of the departments receiving such charges are eliminated, at the source, in the departments in which they occur.

There are numerous statistical figures that may be developed in the departmental analysis, Fig. 9, which will aid in judging the cost results by departments. For example, at the bottom of the sheet, for Department 25, is shown the unit variations from the established tolerances for the pertinent control figures of the department.

In the non-productive departments the statistical information generally varies for each department as well as by plant. For example, heat, light and power, Department 4, as illustrated, indicates that the necessary power was produced on the premises. It may be desirable to show the full cost and total cost per thousand pounds of steam produced. If the power generated is steam, the hp.-hr. cost is shown, or if electric current is generated, kw.-hr. cost is recorded for comparative purposes.

The choice of the statistical information to be developed rests with the management, which may be influenced by the desires of department heads.

Tractors for Wrecking Old Buildings

Old shop buildings are frequently a constant expense as well as an eyesore. But it costs money to take them down and the salvage of material is frequently less than the labor involved.

Fire and dynamite have their place in wrecking but not when there are adjoining buildings. One modern way is to hitch a heavy cable in available spots and pull the building down with a powerful tractor. Recently a job of wrecking by this method was performed quickly and completely. Brick walls and heavy roof timbers were pulled down in a hurry with no thought of salvage, and the site was cleared in short order.

Welded Joints in Copper and Copper Alloy

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Practice to be followed and precautions to be observed are given for the fabrication of small tanks

WITH the popularization of various welding methods many attempts were made, in fact, are still being made, to manufacture small copper tanks by welding. Two difficulties were at once apparent:

1. It was found that by no welding method thus far developed could the cold work strength of the metal be retained in the base metal adjacent to the weld. The designer, therefore, was faced with a loss in strength, measured by a drop from perhaps 50,000 lb. per sq.in. to 35,000 lb. per sq.in., and he was forced to use extra thickness throughout to compensate for the lower strength at the welded seam.

2. Worse still, the copper generally available is a very pure copper which, however, carries 0.03 to 0.07 per cent oxygen in the form of cuprous oxide. The welding heat is prone to cause a redistribution of the cuprous oxide in a narrow zone adjacent to the weld which may further reduce the strength to only 15,000 lb. per sq.in.

A third source of difficulty for the welder, the high heat conductivity of copper, may be mentioned here, though in the thinner gages, normally used for the 30 to 60-gal. tanks, this handicap can be readily overcome by the use of sufficient heat in the welding operation.

In spite of these handicaps, numerous welded copper vessels have been made and put into service. Many times the important thing is to have the vessel of copper for its chemical properties, the pressures being light or the shell supported so that soft copper would serve. When this is the case, a fusion weld in copper is readily made by the more common welding methods as the oxyacetylene torch, the carbon or the metallic arc.

Welding Rods

In welding copper a deoxidized copper or copper alloy rod should always be used for the weld metal. This rule should be observed whether the base metal be ozygen-bearing or deoxidized copper. The more common welding rods for copper are: (1) copper deoxidized with silicon, or (2) copper deoxidized with phosphorus, (3) phosphor bronze or (4) Everdur. These rods can be used with the oxyacetylene torch or with the electric arc.

The first two will yield weld metal having a strength about on par with the dead soft base metal, while both the phosphor bronze (having a sufficiently high tin content, 4 to 10 per cent and the Everdur will yield weld metal considerably greater in strength than the soft base copper. In fact the 10 per cent tin phosphor bronze and the Everdur weld metals will have a strength in the as-welded condition comparable to copper in the cold-rolled condition, that is, a tensile strength of 50,000 lb. per sq.in. or better.

The principal limitations to the use of well-established welding methods for copper are found in the weakened zone of the oxygen-bearing copper and the high heat conductivity of the metal. The former can many times be overcome by hot forging the finished weld at a dull red to black heat and reheating to a bright red for recrystallizing.

The high heat conductivity limits the application of the arc, and the metallic arc in particular, to a thickness of base metal of $\frac{1}{8}$ in. It is difficult to raise the heat, which in the usual welding generator means an increase in current, to a value high enough to heat the base metal properly without losing too much weld metal by bad sputtering.

At least one electrical manufacturer has attempted to overcome this difficulty by the use of a generator having a higher working e.m.f. by means of which a fairly steady 40-volt arc can be maintained. The higher energy of the long arc, with a given current value, heats the base metal to better advantage, and superheats the weld metal so that it is better able to alloy with the base metal, while the melting rate of the rod is still safely within the spattering point. Some good welds are being made by means of the 40-volt metallic arc and a 10 per cent tin phosphor bronze-welding rod in $\frac{3}{16}$-in. to $\frac{1}{8}$-in. thick copper.

As was pointed out by the late S. W. Miller in 1926 and by the writer in 1929, deoxidized copper sheet will weld appreciably better and with a higher strength than the more common oxygen-bearing copper. In other words, it is a comparatively simple matter to develop the strength of the dead soft deoxidized copper sheet using the oxyacetylene torch with Tobin bronze. Or a fusion weld may be made using silicon copper, phosphor bronze or Everdur welding rod. Either one of the three rods last named can be used with the metallic or carbon arc as well as the oxyacetylene torch. A yellow bronze can be applied only with the torch.

Deoxidized copper has not, however, come into general use, due in part to the rather slow progress in the welding of copper and to the relatively slight gain in welded strength, but principally to the fact that higher strength, more weldable copper alloys have become available. The most noteworthy of these high strength, weldable copper metals is the silicon-manganese alloy known as Everdur, patented by Charles B. Jacobs in 1925.

Everdur Welding Methods

Everdur "A" is readily welded by any of the usual methods. By one manufacturer or another, each of the four most common welding methods, the oxyacetylene torch, the metallic arc, the carbon arc and the resistance seam weld, is in commercial use. In discussing these various methods we are interested princi-

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pally in the ease and economy of welding as a fabricating process, and the strength, ductility and appearance of the finished weld. As for the costs, we can form only a rough estimate, since they are dependent upon such variables as production capacity and labor rates as well as the more direct welding charges such as time, heat and material costs.

Everdur "A" in all thicknesses from 0.025 to 1½ in. or more is welded by means of the oxyacetylene torch. This method works best when the material to be joined is free to come and go in the plane of the sheets. An attempt to oxyacetylene weld with the edges of the seam clamped rigidly is prone to result in hot short cracks. If the end of the seam is open 2¼ to 2½ per cent of the length of the seam, it will usually close properly as the seam is finished. A good deal, of course, depends upon the size and thickness of the sheet and the speed and continuity of welding.

For all sheets under discussion, that is, up to ¼ in. in thickness, an oxyacetylene weld is invariably made in one pass. Everdur welding rod of the same composition as the base metal is used. The weld, therefore, is a true fusion weld. In fact, the one word of caution necessary to insure a strong weld is that the base metal be fused at the time the weld metal is melted into place.

Plenty of flux, in which the essential constituents are fused borax and boric acid, is required. A good commercial brazing flux will usually answer. This is one respect in which gas welding of Everdur differs from arc welding. The latter methods call for little or no flux.

The low heat conductivity of Everdur, approximately 8 per cent of that of copper, as well as its moderate melting point of 1866 F., enables one to complete a weld at a rapid rate and with little distortion because of spread of heat into the surrounding sheet. A slightly oxidizing flame with its greater concentration of heat (as compared to the neutral flame) is preferable. Speed in welding is desirable from the standpoint of soundness and grain size of the weld metal.

Carbon Arc Is Faster

Most of the manufacturers who started welding Everdur with the oxyacetylene torch have changed to the carbon arc because of the greater speed, lower distortion (which means the metal can be rigidly clamped) and heat economy of the latter. The oxyacetylene torch, however, appears to find a place in welding extremely thick, ¾ in. or above, and extremely thin, about 0.025 in. sheets.

The strength, ductility and quality of the weld made by the oxyacetylene torch are excellent. Such a weld should develop in the sheet a tensile strength of 54,000 to 58,000 lb. per sq.in. with an elongation in 2 in. of 30 to 60 per cent. The ductility is especially noteworthy. No other method of welding Everdur produces weld metal as ductile as this without some special treatment such as peening and annealing.

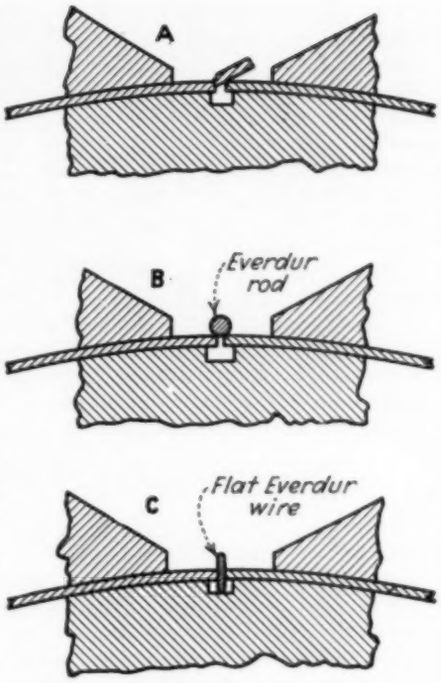

Fig. 1—Three methods of supplying weld metal when using the carbon arc are: *A*, upturned edge; *B*, round Everdur rod laid on butt joint; and *C*, flat wire or strip melted in place

While we are concerned more particularly with fusion welds, it may not be out of place to point out that the metal may be joined without itself being fused when the weld metal is silver solder, brazing solder or Tobin bronze. Using the latter weld metal, it is not difficult to develop the full strength of the soft Everdur sheet. The one thing of prime importance is that the seam to be welded be painted liberally with a good brazing or silver soldering flux suspended in alcohol before the heat is applied. If a film of silicon oxide is allowed to form on the base metal ahead of the brazing heat the bronze will have only a low strength grip.

In general, the same rule applies to the soft soldering of Everdur—the surfaces to be soldered must be painted with a flux, or better still, with a flux plus finely divided solder, before the heat is applied.

Everdur is readily arc welded using a metallic arc electrode wire of the same alloy as the base metal. High speeds are possible where an automatic welding head is available. Since the polarity is reversed, the wire melts rapidly, coming down in large drops. A long arc of 30 volts or more is commonly used with 90 to 125 amp. on a ⅛-in. wire, 190 to 200 on a 5/32-in. diameter wire and 210 to 240 on a 3/16-in. diameter electrode.

The proper heat is important as too low a value means incomplete penetration at the bottom of the bead and entrapped gas holes at the top. Too high a heat is likely to cause hot short cracks and too great fusion of base metal. Little or no flux is used as it is not needed for the proper union of the weld metal to the base metal, and it is inclined to make the arc wild.

The quality of the weld metal deposited from the bare metallic arc electrode is not as good as that fused by the oxyacetylene torch or the carbon arc. It is usually peppered with extremely minute particles of black oxide and has a coarse dendritic structure. For these reasons the ductility in the as-welded condition is much lower than that of metal deposited with the oxyacetylene torch, though its strength is quite high, being of the order of 52,000 lb. per sq.in., or better. As has been pointed out before, peening of the weld metal with subsequent annealing will break up the coarse dendrites into a much finer structure with marked improvement of both the ductility and strength.

Little Distortion

A number of range boiler manufacturers have found in the carbon arc a simple and economical method of welding. The edges can be clamped rigidly into position; there is little heat to run into the sheet, causing distortion and strain on the weld; the weld progresses rapidly at the rate of 12 to 30 in. per minute; and the weld metal is generally sound and reasonably ductile.

Moreover, uniformity may be secured by the melting of an exact quantity of metal. The weld metal is in every case identical with the base metal and may be obtained as illustrated in Fig. 1. The backer made up of copper or steel may be rounded to conform to the radius of the shell. A groove 1/16 in. deep by approximately 5/32 in. wide helps in aligning the edges of the sheet and allows for a narrow reinforcement on the bottom of the seam.

When the carbon arc is being used for welding in heads and spuds, a round welding rod fed into the arc as needed is the most useful. However, the edges of the shell are frequently melted down to provide weld metal for holding on the head, and the edges of the forged spud flange are sometimes melted to secure the latter.

The size of carbon will depend largely

on the thickness of the sheet being welded. A carbon small enough to keep a point as it burns away is desirable. In general this means a size between 1/2-in. and 3/8-in. diameter. A high heat conductivity graphite carbon will be found economical to use in preference to a softer low grade carbon.

A long arc is preferable to a short arc except for the difficulty of keeping it centered on the seam. A long arc will burn up the carbon to the dioxide before the carbon can reach the plate. Hence, there is less likelihood of porosity (the carbon dioxide is not as soluble in molten Everdur as carbon monoxide), and there is less trouble from carbon deposits. The magnetic pointing of the arc stream is desirable.

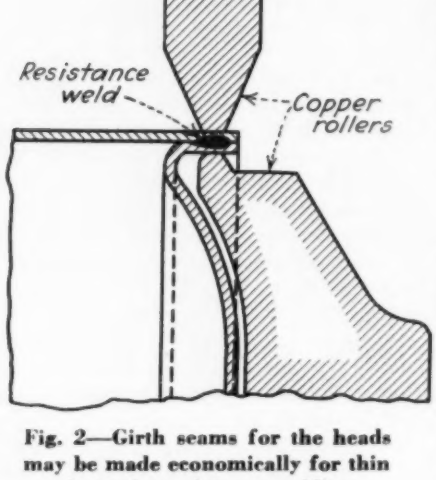

Fig. 2—Girth seams for the heads may be made economically for thin sheets by resistance welding

The current value or arc heating capacity is best determined for a given setup by an actual trial. It may vary from 30 amp. on thin sheet to 250 or more amp. for the thick sheets as 1/4 in. and thicker. The heat required depends, of course, on the speed of travel as well.

Thin Weld Stronger

In general a low flat bead with perhaps 30 to 50 per cent reinforcement is preferable to a thicker bead with, say, 100 per cent reinforcement. The thinner weld will usually be found stronger and more ductile than a thicker one. This fact is mentioned because it is not generally understood. Even an experienced welder will often select a heavy bead as having greater strength than one with much less reinforcement.

Fig. 3—In this oil displacement cell, two diaphragms are simultaneously resistance seam welded to an Everdur ring

Table I—Physical Properties of Commercial Welds in Everdur Tanks

Mark	Size Tested, In.	Tensile Strength, Lb. per Sq. In.	Elongation in 2 In., %	Fracture, Remarks
	Everdur Sheet before Welding			
1	0.0773 x 1.123	60,800	65.5	Silky, fine grain
1	0.0990 x 1.124	59,300	65.3	" " "
2	0.0825 x 1.500	68,700	57.0	" " "
2	0.0728 x 0.749	60,300	65.0	" " "
3	0.0747 x 1.501	60,300	73.0	" " "
3	0.1099 x 1.499	59,000	68.0	" " "
4	0.1001 x 1.497	58,700	68.5	" " "
4	0.0755 x 1.499	58,500	70.0	" " "
4	0.0453 x 0.996	58,500	65.0	" " "
	After Automatically Carbon Arc Welding (*Bead 0.145 in. thick, 0.35 in. wide*)			
1	0.0779 x 1.135	59,400	34.0	At edge of weld
1	0.0932 x 1.125	61,000	39 3	" " " "
	After Manually Carbon Arc Welding (*Beads 0.150–0.184 in. thick, 0.27–0.28 in. wide*)			
2	0.0847 x 1.113	57,930	38.2	At edge of weld
2	0.0720 x 1.172	57,000	37.0	" " " "
	(*Bead 0.155 in. thick, 0.46 in. wide*)			
3	0.0752 x 1.163	52,570	24.0	At edge of weld
3	0.1032 x 1.159	49,100	16.7	" " " "
	(*Bead 0.111 in. thick, 0.38 in. wide*)			
4	0.0443 x 1.130	55,100	37 2	At edge of weld
	Oxyacetylene Welds (*Bead 0.204 in. thick, 0.44 in. wide*)			
4	0 1064 x 1.205	58,530	42.8	At edge of weld
	(*Bead 0.158 in. thick, 0.46 in. wide*)			
4	0.0746 x 1 204	62,170	39.5	At edge of weld

Particularly is this true when spuds are being attached to a relatively thin shell or the shell is being welded to the head or bottom. In such cases it is desirable that the under metal be not entirely fused through.

A light sprinkling of finely powdered dry flux is desirable in carbon arc welding as it helps in the flow of the metal and produces a seam having a cleaner appearance. Powdered borax glass, a good water-free brazing flux or Everdur flux (90 per cent fused borax plus 10 per cent sodium fluoride), may be used. Too much flux makes the carbon arc erratic.

Where tanks and containers are made of thin Everdur sheet, say, 0.010 to 0.035 in. in thickness, electric resistance spot and roller seam welding offer an economical and attractive connection.

Before inserting the heads, the point on the inner surface tarnished by the welding heat of the longitudinal seam should be polished, as otherwise there may be a leak where it is crossed by the girth seam. The heads are now inserted and welded as illustrated in Fig. 2. At least one head must be skirted as shown in order to allow both welding rollers to contact properly with the two surfaces.

Fig. 3 shows a somewhat more involved resistance seam weld. In this case two flexible Everdur diaphragms are welded simultaneously to opposite flanges of a channel-shaped Everdur ring. The job was worked out so that consistent welds are being obtained on a thyratron-controlled resistance seam

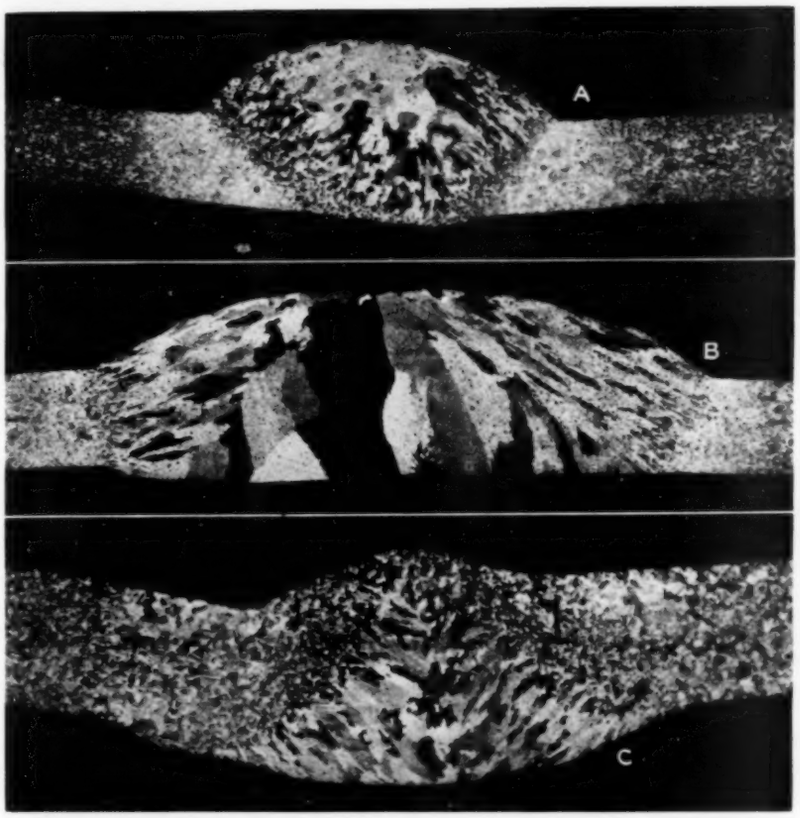

Fig. 4—Sections of different types of Everdur welds are compared: *A*, manual carbon arc weld, excessive reinforcement, good strength; *B*, manual carbon arc weld, excessive heat, indifferent strength; *C*, oxyacetylene weld, excellent strength and ductility

welder that are strong and tight, showing no leaks when resisting 40 lb. of air pressure. Another piece of apparatus assembled by a combination of resistance spot welding and resistance seam welding is the evaporator used in small refrigerators.

The proper technique for resistance spot welding and seam welding Everdur differs materially from that used in welding steel sheets. In Everdur, as in most copper alloys, the metal must be molten to make a weld. It does not have a weldable, plastic range as does steel. The pressure control, therefore, must be more accurate, and it is usually much lighter. The current value is, in general, slightly greater with a longer current-on period, and the current density, determined by the area or width of the electrode face, is likewise important.

An extended investigation as to the resistance seam welding properties of Everdur sheet in thicknesses from 0.020 to 0.065 in. showed tensile strengths ranging from 55,250 to 61,030 lb. per sq.in. with 25 to 52 per cent elongation in 2 in. for soft Everdur, and 62,180 to 73,500 lb. per sq.in. tensile strengths with 3 to 8 per cent elongation in 2 in. for the cold rolled metal. The pressures on the rollers were 175 lb. for the thinner sheets and 375 lb. for the 0.065-in. thick sheets. About 70 per cent of the capacity of a 100 kv-a. welder was used.

Welds made under laboratory supervision and welds made in commercial practice are frequently very different in point of strength and ductility. In order, therefore, to secure an accurate picture of what is being done commercially in the manufacture of Everdur tanks by welding, representative samples of commercially welded Everdur sheets were obtained from manufacturers of range boilers and tested with results as given below. Tests are given in Table I for the sheets before and after welding, the results being the averages of two or more tests in each case. In some instances the same welding shop made test welds on several thicknesses of sheets. In every case the welded samples were tested with the bead intact.

It will be noted that the results obtained with the manually operated carbon arc are slightly lower than those obtained with the automatic arc which melts an exact amount of metal per inch of seam at a definite rate.

At *A*, Fig. 4 is a typical section of a manual carbon arc weld. The metal is generally sound, there being comparatively few microscopically small pinholes near the top of the bead, though it is the writer's opinion that the same heat with slightly less reinforcement would have shown an increase in both soundness and strength.

Fig. 4*B*, typical of the manual carbon arc welds, explains the lower values in these welds. Clearly too much heat has been used. While the metal is sound, except for extremely minute pinholes, the abnormally large grain size indicates a low yield point and slightly low tensile strength.

At *C* is an excellent example of an oxyacetylene weld. The metal is perfectly sound and the weld is narrow with ample reinforcement on top and bottom. The weld was probably made by a small, sharp (oxidizing) flame at a fast rate. The heat flow is greater into the base metal than is the case with the carbon arc, as is evidenced by the growth of the grain in the parent metal, but it is not great enough to impair the strength of the annealed metal while it does improve the ductility.

Several manufacturers of hot water heaters are using seamless drawn shells. They at once eliminate the highly stressed longitudinal seam and one girth seam. Since the shells are cold drawn, the tensile strength of the Everdur shell wall is of the order of 80,000 to 90,000 lb. per sq.in. tensile strength with a yield point at 0.75 per cent extension of 65,000 lb. per sq.in. or more. This means, of course, that a thinner shell can be used for a given water pressure than is the case when the minimum strength is controlled by a longitudinal weld whose strength may not exceed 55,000 lb. per sq.in.

However, even with the drawn shell, there remains considerable welding. The girth seam securing the bottom and the numerous spuds, flue and heater tubes should all be securely welded. A simple connection, securing the Everdur bottom to the cold drawn Everdur shell, is illustrated in Fig. 5. The bottom of rather heavy gage metal is drawn with a skirt not less than 1¾ in. long having an outside diameter approximately ½ per cent greater than the inside diameter of the shell. The bottom is entered into the shell concave in either direc-

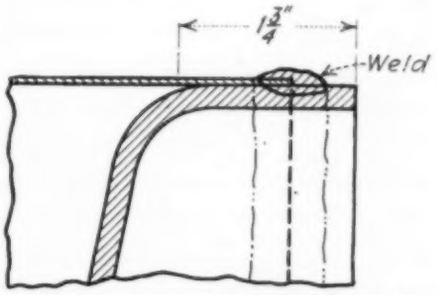

Fig. 5—A heavy gage bottom is welded to a seamless drawn shell by means of the carbon arc

tion so that the edge of the shell lies hard against the skirt for at least ¾ in., leaving as much more of the skirt exposed. A carbon arc weld is run rapidly around the edge of the shell, melting it back about $\frac{1}{16}$ in. and covering it for another ⅛ in. with weld metal. The bead will be centered just outside the edge of the shell, the bottom being sufficiently thick to take it without itself fusing all the way through.

A weld made in this manner will retain the cold work strength of the shell wall nearly to the edge of the bead. The fact that it is lying hard against the heavier bottom for at least ½ in. beyond the weld will prevent its being overheated.

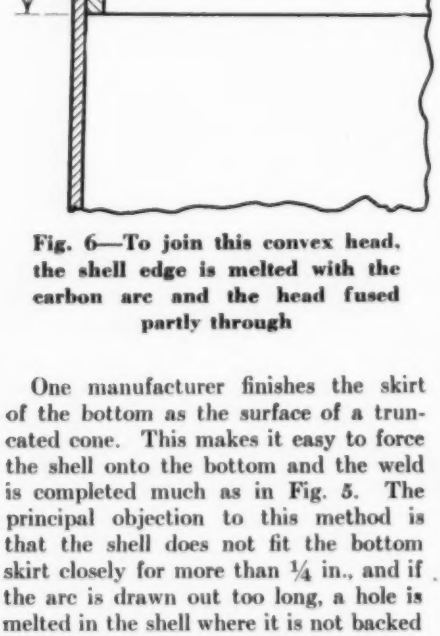

Fig. 6—To join this convex head, the shell edge is melted with the carbon arc and the head fused partly through

One manufacturer finishes the skirt of the bottom as the surface of a truncated cone. This makes it easy to force the shell onto the bottom and the weld is completed much as in Fig. 5. The principal objection to this method is that the shell does not fit the bottom skirt closely for more than ¼ in., and if the arc is drawn out too long, a hole is melted in the shell where it is not backed up by the thicker metal of the bottom. At lease one other manufacturer brings the edge of the shell flush with the edge of the bottom and makes a simple edge weld with the carbon arc.

With the shells rolled up from annealed sheet of reasonably heavy gage, the heads, if placed concave outwardly, may be welded as in Fig. 5. Since the shell is, however, already in the annealed state, it is not so important to keep the heat flow into it low. More of it can be melted though the operator should be prepared to add a little reinforcement from an Everdur welding rod. Or the weld can be made by the oxyacetylene torch.

Usually the top is placed convex outwardly. In this case the most convenient method of welding is illustrated in Fig. 6. In this case a skirt of approximately 1 in. will be sufficient. The shell is forced over the head until its edge stands away slightly from the head about ¼ in. beyond the point where the knuckle radius begins. This edge is now melted down by the carbon arc as illustrated, while simultaneously the outer surface of the head is fused. The edge of the shell serves as weld metal so that little or no welding rod is needed. The strongest weld is one in which the head is not fused completely through. With metal $\frac{3}{16}$ in. thick or thicker this is possible.

A butt weld, head to shell, can, of course, be made but this is rarely resorted to in the case of the popular-sized range boilers. Where it is employed, a 1-in. wide × ¼-in. thick butt strap should be used on the inside of the seam as a backer and left in place in the finished boiler.

Suitable Temperature for the Machine Shop

MARTIN H. BALL

There are many shops working under conditions that could be greatly improved from economic and efficiency standpoints. At the same time, much could be added to the comfort of the workman without going into automatic control of heat, which many might consider more expensive than their circumstances would permit.

There are a few points that no shop owner can afford to neglect. The following outline is not given to cover all that could be profitably done but rather to call attention to some of the points that are frequently neglected and to set forth some of the benefits that may be derived.

It goes without saying that whatever type of heating system is used, that it should be kept free from leaks and in good working order.

Thermometers should be placed about 5 ft. 6 in. from the floor, well away from outside walls and from places that would be affected by door openings or sudden changes from other causes.

Precision measuring instruments are guaranteed accurate only at a temperature of 68 F. However, man-controlled heat regulation, to be practical, requires some leeway, and experience has proved that a minimum of 65 F. and a maximum of 75 F. answer for average shop work.

Temperature conditions should be carefully watched, and the shop brought to the required temperature at least one hour before work commences. There is so much metal in the tools and materials that they cannot be comfortably handled if below the room temperature, and workmen are inclined, under such conditions, to be slow in getting into their regular pace. A workman loses the fine sense of touch required for taking accurate measurements when he is not comfortably warm.

An extreme case of dealing with different temperatures occurred when it became necessary to take a measurement of one part already machined which was located outside the shop where the temperature was 25 F. The shop at the time registered 65 F. After making an allowance of 0.016 in. for the difference in temperature on a diameter of 60 in., the mating piece was machined and the fit proved to be satisfactory.

The amount to be added for the dimension of the warmer piece was determined from a table of coefficients of linear expansion, the figure for iron being 0.00000672 in. per deg. F. Thus $0.00000672 \times 60 \times 40 = 0.0161$ in. +

Another example was where an unusual course was followed on a job that required close work in machining diameters of about 48 in. on brass castings. Trouble was encountered when using a steel gage. Interchangeability could not be maintained until a brass gage was substituted for the steel. The brass gage was subject to the same linear expansion as the work during temperature changes, whereas the difference in the two metals when the steel gage was used added to our troubles.

Thus the difference in the two metals was (coefficient for brass = 0.00000928; for steel = 0.00000672) $0.00000256 \times 48 = 0.00012288$ for each degree of temperature change. The temperature at times was as much as 10 F. below and above the standard 68 F. Thus $0.20 \times 0.00012288 = 0.0024$ in.+ which represents the difference in the gage and the work.

Workmen as a rule do make allowance in their measurements for the heat generated by the friction of cutting, but as a rule do not make allowance for shop temperatures, with the result that variations and poor fits are found on the assembly line that could be avoided to a great extent by an even and proper maintenance of shop temperature.

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K. H. CONDIT F. H. COLVIN
EDITORS

A Racket Code

EVEN while the National Industrial Recovery Act was still being debated it was evident to any one who understood labor problems that Section 7 (a), the much discussed labor provision of the Act, would lead to trouble. We pointed out at the time that all the restrictions were aimed at the employer, none at the employee or those who might constitute themselves as his representatives.

What happened is history. Organized labor hailed Section 7 (a) as a blanket authorization to organize all of industry, and is still hard at the job of organizing. Industry woke up too late to the significance of the section and then endeavored to protect itself by the Merit Clause.

One such clause got through, but others were knocked out as fast as they appeared. The situation between industry and NRA became strained, some industrialists taking the belligerent stand that they would close their plants rather than yield. Some still feel that way about it.

THEN the President wrote this letter to General Johnson to clarify his position:

"Following our recent discussion of various misunderstandings and misinterpretations of Section 7 (a) of the National Industrial Recovery Act, I wish to advise you of my position.

"Because it is evident that the insertion of any interpretation of Section 7 (a) in a Code of Fair Competition leads only to further controversy and confusion, no such interpretation should be incorporated in any Code. While there is nothing in the provisions of Section 7 (a) to interfere with the bona fide exercise of the right of an employer to select, retain or advance employees on the basis of individual merit, Section 7 (a) does clearly prohibit the pretended exercise of this right by an employer simply as a device for compelling employees to refrain from exercising the rights of self-organization, designation of representatives and collective bargaining, which are guaranteed to all employees in said Section 7 (a)."

SINCE this statement by the President says almost exactly what the employers wanted to say through a Merit Clause, there is no point in continuing the fight. After all, a positive statement like this one, coming from the President, has much more force than a clause in an industry code.

But, as we have also pointed out in *American Machinist*, the door is still open for all sorts of racketeering. Witness what has been happening in the Detroit toolmakers' strike lately. While proof is hard to find, it is at least reasonable to believe that racketeering is in the picture there.

CAREFUL STUDY of the racket problem is going on in NRA and Department of Justice circles. There is talk of a code or agreement that will keep labor organizers within bounds as definite as those restricting the employer.

If such a code or agreement is not forthcoming there is no alternative but a revision of Section 7 (a) in the next Congress. The gangs that flourished under prohibition will naturally try to "muscle in" on industry when repeal cuts off their old means of livelihood. Industry must reckon with this menace and make sure that members of Congress understand how serious it is. It is not too early to start educating now.

A New Plan for Reemployment

Gerard Swope's proposal for reorganization of the NRA is a bold one but one that fires the imagination at its wide potentialities for the improvement of business. It will be hailed by industry generally and by thousands of workers disappointed at the slow pace at which they have been returned to their jobs.

Those who have faced the facts squarely will admit that, regardless of its underlying merits, the Recovery Administration as now constituted has operated as a deterrent force on business recovery. This influence is based on a widespread feeling that the promised opportunity for self-government by industry has been subjugated to a policy of Federal domination.

Business wants to move ahead. Industry wants to resume its major job of creating wealth that will raise living standards on a broad scale.

One influence after another has been blamed for the lag in what promised early in the summer to be a steady emergence from the years of depression. A variety of measures have been tried to promote the use of credit which would lubricate the idling wheels of industry. There is every evidence that for some time ample credit has been available but the will to utilize it has been lacking, suppressed by the threatening cloud of artificial restriction.

The new Swope plan will lift this cloud. It will create an opportunity for real industrial self-government and banish the threat of bureaucratic control.

The plan is yet only a proposal under advisement. Many of its details have still to be worked out, and already the rumblings of a strong opposition may be heard. Some leaders of organized labor see in it an industrial Fascism. Others claim it violates the terms of the Recovery Act. And those who oppose the plan on principle will find a thousand and one reasons why it should not be made effective.

General Johnson's indorsement is significant. He has enforced the Act vigorously and literally. He has persistently kept to the fore the stated purposes of the Act to promote recovery and to aid reemployment. His prompt seconding of Swope's proposal indicates his unqualified belief that the plan will aid materially in achieving these objectives.

Gerard Swope is to be congratulated upon his keen insight into a complex economic problem and upon his courage in bringing forward his proposal at this opportune time.

• CHIPS •

Washington—Johnson goes on speaking trip to sell NRA to doubters . . . Newspapers start criticism of NRA shortcomings . . . In line with plan to rotate membership on Industrial Advisory Board, Teagle, Swope, Finch, Elliott and Moffett retire, to be succeeded by Pierre duPont, Williams, Taylor, Flanders and Wood . . . Swope offers plant to prevent degeneration of NRA into a bureaucracy by turning code authorities over to a Chamber of Commerce and Industry . . . Five Western governors meet with Roosevelt to draft program of farm aid . . . Agreement by Ford to report on wages and hours and to bargain collectively with his men removes NRA objections that barred him from getting Government orders.

Foreign—Daladier cabinet falls and is succeeded by one almost identical formed by Alfred Sarraut and pledged to sound money and budget reduction . . . Litvinov starts for U. S. to discuss recognition of Soviets . . . Japan expresses alarm at prospect . . . Siamese rebellion crushed . . . Mussolini sees world salvation through Fascism . . . Disarmament Conference adjourns . . . 2,620 couples married en masse as first step toward Italian mass production record.

Finance—A. H. Wiggin, late of Chase Bank, has a bad week with Senate committee and rejects his $100,000-a-year pension . . . R.F.C. starts buying gold to lift commodity prices . . . Results not entirely satisfactory . . . Persuasion having dug up only $40,000,000 of hoarded gold, prosecutions will be tried . . . Federal Trade Commission exempts issues of under $100,000 from Securities Act restrictions . . . New England business men and Mid-West economists firm against inflation.

Industry—N.R.A. statistician reports 4,000,000 back at work by October 1 . . . Code adds 1,250 workers, $1,333,000 payroll to Standard Oil of N. J. . . . General Motors breaks up Buick-Olds-Pontiac sales combine, appoints general manager for each company . . . Steel industry compromises with Roosevelt on rail prices, captive mines . . . Detroit mob in automobiles wrecks seven tool and die plants . . . NRA boosts Westinghouse payroll $5,000,000 . . . Firestone places 250-ton order with Republic Steel for stainless steel for beer barrels . . . Railroads to get $135,000,000 from PWA for rails and Pennsylvania electrification . . . Survey of railroad equipment needs planned . . . Navy orders engines for four submarines from Winton.

Trade—Balance of trade up, $13,000,000 in September . . . Retail code is signed and goes into effect . . . Small retailers in little towns exempt . . . Wholesale food prices at $1.91 against $1.64 last year . . . General wholesale index practically stationary.

Indicators—Bank clearings up 10 per cent over 1932 . . . *Business Week* index holds at 60.4 . . . Carloadings decline seasonally . . . Electric power production rises moderately . . . Steel production rate down to 25.2 of capacity.

Swope Offers Plan for Industrial Administration of Recovery Act

At a meeting of the National Business Advising and Planning Council, November 1, Gerard Swope presented a plan for industrial self-government under the NRA codes of fair competition. The proposal deals with the problem of creating a permanent set-up for code administration in which industry itself, rather than the Federal or State government, will be the motivating force.

The plan contemplates setting up a National Chamber of Commerce and Industry which will have three main divisions: (a) Commerce or Trade covering the various codified retail and wholesale distributing organizations; (b) Industry or Manufacturing, to include the codified national manufacturers' associations, with kindred interest grouped together under such bodies as the National Metal Trades Association; (c) Associations representing local or geographical divisions.

For economic and statistical information, the present National Industrial Conference Board would be the nucleous with other existing independent bodies included. Standardization would be handled and extended by the American Standards Association which would become part of the National Chamber. Such of the present Bureau of Standards work which the government may deem advisable would also be taken over.

Central control would be vested in a board of governors elected by delegates to the chamber. The board in turn would elect its officers and an executive committee. The Secretary and Assistant Secretary of Commerce would be members of the board.

A panel would be selected by the board of governors from which would be drawn a board of appeals, to sit at Washington to act on questions arising from code enforcement. Members of the board of appeals would be rotated at four-month intervals.

Financing would be taken care of by pro rata assessments from present trade associations to which the majority of manufacturers and merchants now belong.

An important advantage cited by Mr. Swope is that such a set-up would speak and act for commerce and industry as a unit. The central organization could work out nationally better methods of maintaining better relations with employees and consider with representatives plans that would promote greater security for them. It would continue the advantages of mass production by making the products of the machine available to an even larger number of people.

According to a statement from the White House on November 3, the President does not feel that the time is propitious for a change in program. It was stated that so many new elements had to be contended with that industry must develop along many lines before administration officials would be satisfied that it would run itself.

Gen. Johnson, however, heartily indorsed the plan, saying that it in no way interferes with the NRA or government participation and supervision.

Violence in Detroit Toolmakers' Strike

On Saturday and Monday, Oct. 28 and 30, the first serious outbreaks of mob violence marked the progress of the tool and diemakers' strike that was ordered on Sept. 28. Informed opinion in Detroit is to the effect that the attacks on several independent tool and die shops were made by a few of the more hot-headed strikers aided and abetted by communist and I.W.W. gangs. One observer believes that the raids are evidence that the strike has failed, another that the violence was distinctly contrary to the policy of the original strike leaders.

Reports to the National Labor Board from its Detroit Regional Board are to the effect that partial settlement has been made, several plants having come to terms with their men. The unfortunate part of the whole thing is that the rush season is now over, most of the work having been farmed out elsewhere.

Code Approvals Are Speeded

General Johnson has signed the machine tool builders' code. As we go to press, the code has been sent to President Roosevelt, and his signature is expected within the next day or two.

During the past month industrial codification has gathered considerable momentum as reflected by the number of codes approved in the metal-working industry. Of 24 such codes signed by the President up to and including November 2, only seven were through the Washington mill by October 1.

The latest to receive official sanction in this field are those for fabricated metal products, steel castings, rock crusher, and copper and brass mill products industries, all of which are dated November 2.

The code for the Fabricated Metal Products and Metal Coating Industry exemplifies the present trend toward gathering groups, similar in nature but diverse in product, into a single fold. This code is the result of a meeting August 10 of representatives of about 60 trade associations at which the problems of thousands of small shops making metal specialties were discussed. The Fabricated Metal Products Federa-

• INDUSTRIAL REVIEW •

Conflicting reports from different industrial centers characterize opinion on the machinery situation. Some correspondents report that October business was up somewhat and that November is opening satisfactorily, others that nothing much is expected for the few weeks remaining in 1933. The feeling persists that business would advance if monetary and labor uncertainties could be eliminated.

In the Eastern territory, Boston, New York and Philadelphia, inquiries are not so numerous but it is possible to close some of them. Labor disturbances have been few, but uncertainty is holding back buying. Pittsburgh agents are getting plenty of inquiries and enough orders to keep them optimistic for the future. Supply business is improving.

More life in inquiries to offset decreasing orders is the report from Cincinnati. Some Government business in in sight. Conditions in Cleveland are slowly but steadily getting better. Inquiries and orders were both better in October and November is opening up encouragingly. Effects of the tool and die strike are still hampering activities in Detroit but a partial settlement has been made. It is likely, however, that nothing much in the way of equipment buying will materialize until after the shows.

Reports from St. Louis indicate a distinctly better feeling. One protracted strike has been settled and other companies have been successful in getting good orders for machinery. Small tool business is up a little. Current business in machine tools is fairly good but little is in prospect for November and December. Labor troubles are less in Milwaukee, but so is employment.

tion was then formed and notices of the hearing sent to 7,700 concerns.

The code provides a 40-hour week and a minimum wage of 40 cents in the North and 35 cents in the South. For female workers the minimum is five cents less.

For the steel casting industry rates of pay vary from 25 cents in the southern wage district to 40 cents in northern wage districts. A 40-hour week is established. Office workers will receive a minimum of $15 weekly excepting office boys and girls, for which 80 per cent of the minimum is set. It is estimated that the operation of this code will provide work for 3,000 additional workers.

A 40-hour week and 40-cent minimum wage is provided for by the copper and brass mill products industry. Women workers will have a minimum wage five cents lower. The estimate of reemployment in this industry is 5,000 workers at an added payroll of $4,500,000 annually.

While sales in the rock crusher industry in 1932 were 80 per cent of those in 1929, employment was about the same because of a "share-the-work" policy. It is estimated that this code will increase employment by 20 per cent.

Tariff Procedure Set Up by NRA

A recent Presidential order outlined the machinery to put into effect the tariff provisions specified by Title I Section 3 (e) of the National Recovery Act. This order puts the authority for initial action into the hands of General Johnson, who has appointed Oscar B. Ryder to head up this activity to be known as the Imports Division of NRA.

The procedure will be to send three copies of complaints of alleged destructive competition of imports with codified American industries to this division and one copy to the President. Complaints may be filed by "any labor organization or any trade or industrial organization or group which has complied with the National Industrial Recovery Act by having in actual operation a code or agreement pursuant thereto." A special form has been designed for this purpose.

Under the law, action may be taken under Section 3 (e) only when imports of the article subject of complaint are substantial or in increasing ratio to domestic production. Detailed evidence must be furnished that imports tend to render ineffective or seriously to endanger the maintenance of the code.

Mr. Ryder was formerly assistant chief of the Economics Division, U. S. Tariff Commission.

Metal-Working Code Hearings Scheduled

Date	Place	Deputy Administrator	Association
Nov. 8	Willard Hotel	Malcolm Muir	American Gear Manufacturers
Nov. 8	Willard Hotel	Malcolm Muir	National Beverage Dispensing Equipment
Nov. 9	Raleigh Hotel	Malcolm Muir	Commercial Refrigerator Manufacturers
Nov. 9	Carlton Hotel	H. O. King	Gray Iron Founders Society
Nov. 10	Carlton Hotel	Malcolm Muir	Foundry Equipment Manufacturers

A.S.T.M. to Move

At the end of this year, the headquarters of the American Society for Testing Materials will be located in new quarters at the Atlantic Building, 260 S. Broad St., Philadelphia. For the past fourteen years the Society headquarters have been housed at the Philadelphia Engineers' Club but with the growth of the organization these facilities became inadequate. The new location, which will be occupied on a five-year lease, affords about 40 per cent more floor area.

Differences Aired at Bolt Code Hearing

Deputy Administrator H. O. King, presiding at the public hearing, on October 31, of the code of fair competition sponsored by the American Institute of Bolt, Nut and Rivet Manufacturers, served notice that in many respects the code was inacceptable. R. J. Whelan, president of the Institute, presented the code and testified that employment in the industry had risen from 7,489 on June 1 to 11,189 on August 1. A number of requests were filed for separate codes by manufacturers of allied products also made by firms in the bolt and nut industry.

Waldo C. Holden, representing the Metal Trades Department, A. F. of L., asked for a 35-hour week, elimination of district wage differentials, a minimum wage of 45 cents an hour for common labor and $16 a week for office employees, representation for labor on the code authority and recognition of existing union contracts. He also filed 50 affidavits from Birmingham, Ala., complaining that two firms in that district were attempting to discourage union activities.

Administration of the code by a commissioner appointed by the President was requested by Clarence Carlin, of the Anthony Carlin Co. In addition, he stated that statistical data should be collected by disinterested public accountants.

James C. Rea, of the Institute, defended the 40-hour week set up by the code on the ground that any less would prove oppressive. The wage scale, varying from 25 to 40 cents on a regional schedule, was patented after that for the steel code. Deputy King asked why the 68 per cent of the industry not owned by the steel companies should not establish wage rates rather than have them fixed by the 32 per cent owned by the steel companies. He also questioned the 8-cent wage differential between male and female workers.

In questioning Mr. Rea, Mr. King brought out that in 1929, 17,228 employees who worked 60 hours a week received an average wage of 44.2 cents an hour. He criticised the fact that the code would provide only half of this wage on a weekly basis.

Army Gets Funds to Motorize

Of a recent allotment of $25,000,000 announced by the Public Works Administration, $10,000,000 went to the War Department for motorization. $15,000,000 was for aviation construction to be apportioned between the War Department and the Navy Department.

The motorization allotment aids the Army program of substituting motor power for horse and mule power in noncombat service work. Both services hold that the aviation program can be started at once, thus giving widespread employment.

Tapered Roller Bearing Recommendation Approved

Simplified Practice Recommendation R67-33, Tapered Roller Bearings, has been approved by the industry and will become effective on November 1, 1933, according to the Division of Simplified Practice, U. S. Bureau of Standards. The current revision brings the program in accordance with the S.A.E. revised standard, and also covers sizes up to 12-in. bore, together with certain steep-angle bearings for naval and general use.

NRA Not to Restrict Machine Replacement Muir Tells Dealers

Machine tool dealers and builders were assured that they need have no fear that their business would be impaired by reason of any limitations imposed by NRA codes by Deputy Administrator Malcolm Muir at a meeting in Washington on October 26. Mr. Muir's address in part was as follows:

"It is unfortunate that in the confusing early days of NRA the idea was allowed to get abroad that no new machinery was to be bought by industry. Since then soberer analysis has shown that unless we have recovery in the heavy or durable goods industries, we shall have no real general recovery. To you and to me that of course is not news —we have known it from the beginning.

"In this connection many inquiries have come to me registering great concern with respect to the regulations limiting the purchase of productive equipment which were approved last week in the cotton-textile code. There need be no concern. It is the logical following out of the spirit of the Act which as I have said previously is to give each industry the right to get rid of the abuses which have caused tremendous waste and profitless operations. In these regulations is registered the will of an industry which long has been burdened with too much producing capacity and which has kept that industry poor. The intent of the regulations is (1) to prevent unwarranted expansion of plant facilities and (2) to place absolutely no obstacle in the way of purchase of equipment for replacement purposes or to bring plants into balance."

With Assistant Deputy Administrator George S. Brady presiding, a hearing on a Code of Fair Competition for the Machine Tool and Equipment Distributing Trade was held the next day at the Shoreham Hotel.

A proposed code for the industry was presented by William K. Stamets, president of the Associated Machine Tool Dealers. It provides for an average 40-hr. week, with 48 hours permitted three weeks out of every six months to take care of peak demands, and minimum wages of $15 a week with learners receiving $13 for the first six months. Outside delivery men and maintenance employees are exempted from limitation on hours provided they are paid time and one-third for all time over 48 hours per week.

Mr. Stamets said the code committee, of which E. R. Motch is chairman, had made a number of changes in the code as printed for public hearing, and he ran over the new revision and pointed out these amendments as they occurred. One of them eliminated the merit clause respecting labor. Mr. Brady suggested that the changes be taken up at a conference to take place immediately following the public hearing, and this was agreed to.

The American Federation of Labor submitted a brief on hours and wages but sent no one to make an oral statement.

NRA advisers assisting Mr. Brady at the hearing were: Industrial, Mason Britton; Labor, H. L. Brunson; Consumer, Harvey P. Baughn; Legal, Burt T. Ansell, and Research and Planning, John A. Hanley and Rudolph von Huhn.

Mr. Hanley asked that the Research and Planning Division be supplied with all possible data bearing on the industry and code proponents said they would hand him after the hearing figures showing the operations of the industry in as much detail as it had been possible for them to obtain.

The hearing was adjourned, and the meeting turned into a conference to whip the code into final shape.

At the final session of the Associated Machine Tool Dealers, Col. George H. Cherrington, president, Brown & Zortman Machinery Co., was elected to succeed Wm. K. Stamets as president; W. F. McCarthy, Henry Prentiss & Co., Inc., was chosen as vice-president; and Harry Barney, Barney Machinery Co., was re-elected secretary-treasurer. Charles E. Moore, Herberts-Moore Machinery Co., Norton Booz, Federal Machinery Sales Co., and H. L. Rich, Lynd-Farquhar Co., were elected to serve as directors.

G. H. CHERRINGTON

W. F. MCCARTHY

Neilson Presents Grinding Wheel Code

At the public hearing held before Assistant Deputy Administrator George S. Brady on October 26, the code of fair competition sponsored by the Grinding Wheel Manufacturers Association was presented by W. LaCoste Neilson, of the Norton Co., chairman of the association. The code calls for a 40-hour maximum week average over a three-months' period. Minimum wages are set at 36 cents for male and 30 cents an hour for female workers. According to Mr. Neilson production capacity is $50,000,000 annually but normal operation is about $30,000,000. The present production is $7,000,000 a year.

Amendments were proposed to exempt truck drivers, shipping crews and inventory clerks from the maximum hour provisions. Robert H. Winn, representing the Natural Sandstone Association, asked that natural sandstone wheels be exempted which was agreed to by the Code's proponents.

Waldo C. Holden, of the American Federation of Labor, went on record for a 30-hour week and a 50-cent minimum wage with time and a half for overtime.

Railroads Get $135,000,000 from PWA

Two allotments, totaling $135,000,000, were recently announced by the Public Works Administration. One, of $51,000,000, was made for the purchase of steel rails and fastenings; the other, of $84,000,000, was made for completing construction work by the Pennsylvania Railroad in connection with electrification from New York to Washington and for related improvements in the construction of passenger and freight cars.

Both allotments were made with the Presidential sanction after consultation with the Interstate Commerce Commission. They are designed for direct encouragement for the heavy industries and to increase employment in them.

The principal items on the Pennsylvania Railroad's program are:

$15,850,000 for carrying electrification through to Washington for both passenger and freight operation.
16,525,000 for 132 electric locomotives
1,087,000 for 23 multiple-unit passenger cars.
16,000,000 for 7,000 freight cars.
2,611,000 for widening and making two-track tunnel at Baltimore.
2,041,000 for Virginia Ave. tunnel in Washington.
750,000 for reconstruction of tracks at Elkton, Md.

The $51,000,000 allotment for rails will cover 1,000,000 tons of rails and 400,000 tons of fastenings. Orders will be allocated by Eastman. Competitive bids will be obtained for the rail fastenings. Col. Waite described the rail purchase program and Pennsylvania's program as the biggest step that the administration has been able to take to distribute money quickly, and the "first project that touches capital goods with any kind of a thrust. There is no spread as rapid and as far swung as railroad purchasing."

Long Hours Attacked at Tool Code Hearing

Labor representatives charged that they had been forced to work twelve hours per day and sometimes as high as 133 hours a week during the public hearing of the code presented by the Special Tool, Die and Machine Shop Institute held on November 2.

Roy T. Wise, chairman of the Institute's code committees, explained that the men worked as individualists on most of the jobs in this industry and that greater tolerance in hours was necessary. However, it was declared that Sunday work was the exception.

The maximum hours and minimum wage clauses were assailed by R. S. Newham, of the American Federation of Labor. The maximum hour clause provides 40 hours a week, excepting tool, die and special machine designers and engineers or toolmakers, diemakers, pressure mold makers and special machinery builders who could work 48 hours, these limitations not applying to "try-out" men or to "individualists." Mr. Newham contended that this last qualification nullified the whole clause.

Wages for skilled labor were set at a minimum of 70 cents an hour with others to receive not less than 40 cents except learners.

Matthew Smith, representing the Mechanics Educational Society of America, now on strike in the Detroit area, said he had worked 22 years as a toolmaker in England and America and that workers were hired with the understanding they would work twelve hours a day, seven days a week. He also said that one-third of the 1,500 skilled workers in Detroit were at present unemployed.

Used Machinery Dealers Elect Officers

A national organization, to be known as the National Institute of Used Machinery & Equipment Dealers, was formed at a meeting held in Chicago on Oct. 21. M. D. Galbreath, president, Marr-Galbreath Co., was made president of the new association. Other officers selected were vice-president, S. A. deWitt, deWitt Tool Co., and treasurer, C. L. McDonald, McDonald Machinery Co. Dealers from St. Louis, Chicago, Detroit, Pittsburgh, Philadelphia and New York attended the meeting. Executive offices are to be located in Pittsburgh.

Trade Practice Committee Headed by Filene

WASHINGTON—Unfair trade practices between competitors are to be taken care of under the NRA codes, but the unfair trade practices outside the immediate family seemed in danger of being left to wend their merry way, until the recent appointment of a Committee of Business Advisory and Planning Council of the Department of Commerce. This committee, named by Gerard Swope, as chairman of the council, is headed by A. Lincoln Filene of William Filene's Sons Co. and will function as an adjunct of the Council, not in any relation to the NRA. The committee is made up of Everett Griggs, chairman of the St. Paul & Tacoma Lumber Co., Lucius R. Eastman, president of Hills Bros., Dr. Paul F. Nystrom, Columbia University, L. D. H. Weld, McCann-Erickson Co., Roy Dickinson, president of Printer's Ink, John F. Burke, president of B. Altman & Co., James A. Goldsmith, President of Hess & Goldsmith, Morris E. Leeds, president of Leeds & Northrup.

The job will begin with the relations between producers, distributors and retailers, and will extend itself as occasion develops into other fields of business relationships which are not touched by NRA codes. The consumer's angle is to be well considered, both that of the ultimate consumer and that of the buyers in the chain of distribution. The committee will not conflict with any function of NRA.

September Farm Equipment Exports up Sharply

Up 69 per cent above August and 80 per cent above 1932, September exports of agricultural implements showed a decided improvement. Their value reached $1,412,839 compared with $836,536 in August and $783,158 in September of last year.

All types of equipment shared in the gain, but tillage implements, harvesting machinery and tractors showed the greatest increase. Combine shipments, totaling 82 units valued at $91,854 compared to 5 units at $8,081 for the corresponding month last year. Harvesters and binders totaling 264 at $50,276 compared to 94 at $15,190 for September, 1932. Tillage implements at $99,319 more than doubled last year's figure.

Exports of 423 wheel tractors at $279,508 show a most favorable improvement over 158 at $137,305 last September. Tracklaying tractors, to the number of 189 at $287,979, were shipped abroad as against 59 at $100,254 a year ago.

Canada was the chief implement market with purchases of $160,000 for the month. The United Kingdom was second, South Africa third, and Italy fourth.

Belgium Buys More Implements

During the first seven months of the current year, Belgium increased its imports of farm equipment 70 per cent over 1932. The total purchases during this period reached $505,652 as against $295,964 last year.

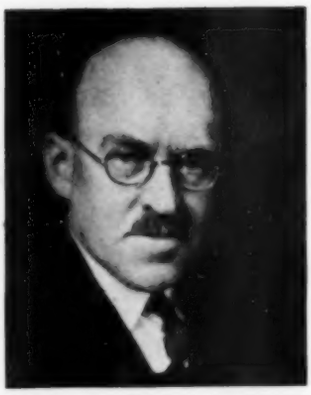
Of these imports, Germany supplied the bulk, accounting for $238,784, followed by France with $181,860 and the United Kingdom with $25,088. Imports from the United States amounted to $2,408 as compared to $6,748 during the first seven months of 1932.

Flanders Named for Industry Board

In accordance with a "rotative system" whereby one-third of the industrialists serving on the Industrial Advisory Board are replaced every four months, Ralph E. Flanders, president, Jones & Lamson Co., was selected for membership last week, together with Myron C. Taylor, chairman of the board, U. S. Steel Corporation; Pierre duPont, chairman of the board, E. I. duPont deNemours Co.; Clay Williams, R. J. Reynolds Tobacco Co.; and Robert E. Wood, Sears, Roebuck & Co. These men will replace Walter Teagle, president, Standard Oil Co. of N. J.; Gerard Swope, president, General Electric Co.; James Moffatt, former vice-president, Standard Oil Co. of N. J.; Austin Finch, Thomasville Chain Co.; and John B. Elliot.

Two objectives are to be gained by the plan: to allow the industrialists now serving an opportunity to give attention to their own business affairs, and to give others a chance to familiarize themselves with the administration of the Recovery Act.

Slates to replace members of the board, who will retire on November 30 and December 31, have also been designated. New members to go in on December 1 are Morris E. Leeds, president, Leeds & Northrup; William T. Kemper, chairman of the board, National Bank of Commerce; A. Lincoln Filene, William Filene Sons; William A. Harriman, president, Union Pacific Railroad, and Thomas H. McInnery, president, Dairy Products Co. Successors to the group retiring December 21 will be Everett G. Griggs, chairman of the board, St. Paul and Tacoma Lumber Co.; F. B. Davis, Jr., president, United States Rubber Co.; Henry S. Dennison, president, Dennison Manufacturing Co.; H. P. Kendall, the Kendall Co., and Thomas J. Watson, International Business Machines Corporation.



RALPH E. FLANDERS

Exports of Machinery During September, 1933

	Sept., 1933	August, 1933	Sept., 1932
Electrical Machinery	$3,871,465	$3,561,785	$3,032,824
Power generating machinery (except automotive and electric)	312,155	366,941	249,766
Construction machinery	174,033	300,119	180,581
Mining, well & pumping machinery	1,218,137	1,189,295	780,257
Power-driven, metal-working machinery	625,118	825,104	1,074,471
Other metal-working machinery	83,234	116,538	87,714
Textile machinery	421,904	402,940	512,140

Exports of Metal-Working Machinery During September, 1933

	Sept., 1933	August, 1933	Sept., 1932
Engine lathes	$19,858	$24,254	$82,273
Turret lathes	14,563	28,035	3,597
Other lathes	9,685	9,246	44,651
Vertical boring mills and chucking machines	3,524	10,920	11,223
Thread-cutting and automatic screw machines	32,066	29,595	22,495
Knee and column type milling machines	15,933	65,615	29,413
Other milling machines	18,857	26,231	55,861
Gear-cutting machines	67,059	78,614	103,309
Vertical drilling machines	10,553	46,192	2,777
Radial drilling machines	3,068	5,553	.....
Other drilling machines	36,435	20,618	39,281
Planers and shapers	1,100	22,488	2,086
Surface grinding machines	10,611	8,409	23,634
External grinding machines	9,295	36,858	26,439
Internal grinding machines	21,170	20,400	88,108
Tool grinding, cutter grinding and universal grinding machines	20,012	27,090	16,247
Other metal-grinding machines	21,345	22,359	81,168
Sheet and plate metal-working machines	48,475	90,989	194,322
Forging machinery	59,350	28,253	27,634
Rolling mill machinery	35,090	63,658	19,633
Foundry and molding equipment	44,644	23,340	28,481
Other power-driven metal-working machinery and parts	122,425	136,387	171,839

Other Metal-Working Machinery

Pneumatic portable tools	20,321	47,729	29,639
Other portable and hand or foot operated metal-working machines and parts	26,017	33,076	32,388
Chucks for machine tools	4,581	5,417	2,635
Machine operated pipe and thread cutters, stocks, dies, taps and other machine-operated tools	17,218	17,775	15,047
Other metal-working machine tools	15,097	12,541	8,005

CORPORATION REPORTS

Chicago Pneumatic Tool Co.

September quarter, net profit $1,190; preceding quarter, net loss $87,627; nine months, net loss $273,976; nine months, 1932, net loss $551,753.

Houdaille-Hersey Corp.

Nine months, net profit $76,027 before dividends on subsidiary; nine months 1932, net loss $296,114; third quarter, net profit $108,664.

International Business Machines

Nine months, net profit $4,378,148; nine months 1932, net profit $5,038,962; September quarter, net profit $1,476,136; September quarter, 1932, net profit $1,496,845.

Intertype Corp.

Nine months, net loss $76,901; previous year, net loss $156,825; September quarter, net loss $15,039; third quarter, 1932, net loss $58,972.

Link-Belt Co.

Nine months, net profit $52,130; nine months, 1932, net loss $319,809; September quarter, net profit $254,875; third quarter, 1932, net loss $26,655.

Minneapolis-Honeywell Regulator

Nine months, net profit $280,953; same period 1932, net loss $62,863; September quarter income, $385,932; third quarter, 1932, net profit $167,756.

Moto Meter Gauge & Equipment

September quarter, net profit $123,702; September quarter 1932, net loss $91,432; nine months, net profit $139,929; nine months 1932, net loss $308,165.

National Acme Co.

Nine months, net loss $309,625; last year, net loss $730,975; September quarter, net loss $46,601; 1932 third quarter, net loss $220,812.

National Cash Register Co.

September quarter, net loss $242,135; September 1932, net loss $915,126.

Otis Elevator Co.

Nine months, net loss $1,257,893; same period 1932, net income $924,766; September quarter, net loss $230,157; preceding quarter, net loss $419,019; third quarter, 1932, net income $358,715.

Packard Motor Car. Co.

September quarter, earnings, 4 cents a share; nine months, net loss $487,084; nine months 1932, net loss $4,416,799.

Pittsburgh Screw & Bolt Corp.

Nine months, net loss $183,297; last year, net loss $621,727; September quarter, net profit $110,691; preceding quarter, net loss $90,063; third quarter 1932, net loss $187,801.

Remington Rand, Inc.

Six months ended Sept. 30, net profit $109,566; same period 1932, net loss $1,301,829; third quarter earnings, $203,656.

U. S. Hoffman Machinery Corp.

Nine months, net loss $129,399; previous year, net loss $696,513; third quarter, net profit $59,759; third quarter 1932, net loss $236,272.

Yale & Towne Mfg. Co.

Nine months, net loss $161,791; same period, 1932, net loss $530,264; September quarter, net profit $27,626; preceding quarter, net loss $82,324; third quarter, 1932, net loss $199,686.

•BUSINESS ITEMS•

The Muncie Gear Co. plant, real estate, machinery and certain finished products have been sold to WILLIAM A. SPURGEON, one of the founders and an officer of the corporation. The sale was made by A. E. NEEDHAM, receiver.

A department devoted to the designing of tools and equipment for manufacturers has been added to the plant of the Schoitz Tool & Gear Co., Waterloo, Iowa.

Barbrick Tool & Machine Co., Hartford, Conn., has been incorporated with a capitalization of $50,000. The incorporators are JOHN W. BARBRICK, Marlboro; JOHN L. MORAN, Hartford, and JOHN L. SENGLE, New Britain.

The Millholland Sales Co., Indianapolis, Ind., on October 1 purchased the goodwill, jigs, fixtures and inventory of the Millholland Corp., which formerly made automatic drilling machines and automatic units. The former company has been manufacturing automatic machine units for some time.

All Westinghouse companies in New York City, including the Westinghouse Electric & Manufacturing Co., Westinghouse Electric International Co., Westinghouse Electric Elevator Co., and Westinghouse Lamp Co., have moved the New York executive and sales offices to the RCA Building, 30 Rockefeller Plaza, New York, N. Y.

The Toledo General Mfg. Co., Toledo, Ohio, manufacturers of the "Demco" line of standard and automatic sensitive drilling machines, has appointed Wilson & Brown, Inc., 30 Church St., as New York representatives.

The Northern Pump Co., Minneapolis, has appointed HUGH L. RUSCH as eastern sales manager with headquarters in the Chrysler Bldg., New York, N. Y. Mr. Rusch was also elected vice-president of the company.

Bantam Ball Bearing Co. has appointed M. B. BARBE as representative for the company in northern Ohio with headquarters at 467 Ohio Ave., N.W., Warren, Ohio.

The firm of Kellogg and Tree, 300 Madison Ave., New York, N. Y., has been formed to take over for clients the job of selling, including the appointment and supervision of jobbers and agents, selection of salesmen and placing of advertising. Members of the firm are DONALD LEWIS KELLOGG, a mechanical engineer, for the past eight years engaged in marketing and distribution problems, and EDWARD WESLEY TREE, an electrical engineer.

W. E. LOY has been appointed general sales manager of the Union Twist Drill Co., Athol, Mass. Mr. Loy was formerly president and general manager of the Ampco Twist Drill Co., Jackson, Mich. He is well known to the automotive manufacturing trade and allied interests.

• PERSONALS •

HAROLD T. YOUNGREN, assistant chief engineer of the Buick Motor division, has been appointed chief engineer of the Olds Motor division of the General Motors Corp., according to an announcement of C. L. MCCUEN, general manager of Olds. Mr. Youngren had earlier connections with the Studebaker, Houdaille and Pierce-Arrow organizations.

HARRY C. GOWRAN, vice-president and general manager of the Hamilton Mfg. Co., Two Rivers, Wis., printing equipment builder, has been elected president to succeed GEORGE S. HAMILTON, resigned.

H. U. HERRICK, president and treasurer of the V. & O. Press Co., Hudson, N. Y., has been elected president of the newly formed Mechanical Press Builders' Association. Mr. Herrick is an authority on the design and use of power presses, thread rolling machines, dies and automatic feeds.

LLOYD JONES, formerly manager of the Salem, Ohio, works of the E. W. Bliss Co., has resigned to become vice-president of the Continental Roll & Steel Foundry Co., East Chicago, Ill.

ROB ROY MACLEOD has been made vice-president and general manager of the Bradford Electric Co., Bradford, Pa.

H. C. SENOUR, secretary-treasurer of the Transue & Williams Steel Forging Co., Alliance, Ohio, has been made a director.

E. A. HIBLER, manager of the enamel branch of the Richmond Radiator Co.'s Uniontown, Pa., works, has been named plant manager and assistant to the president of the United States Sanitary Mfg. Co., Monaca, Pa.

J. F. THOLL, at one time general manager of the Green Island, N. Y., plant of the Ford Motor Co., has been made vice-president, as well as general manager, of the American Tool & Machine Co., Hyde Park, Boston.

O. B. ZIMMERMAN, assistant to the manager of the engineering department and supervisor of materials and standards of the International Harvester Co., retired on Nov. 1. He had been with the company since 1911.

• OBITUARIES •

ROBERT G. HENRY, at one time president and superintendent of the Henry A. Wright Mfg. Co., Hartford, Conn., died October 30. Mr. Henry sold his interest in the company in 1916 to Mr. Wright. Other connections were with the Howe Sewing Machine Co., Bridgeport, and with E. J. MANVILLE, founder of the E. J. Manville Machine Co.

JULIUS J. GOETZ, president and founder of the Western Metal Specialty Co., Milwaukee, died Oct. 30 at the age of 65.

JOSEPH HEIDENKAMP, president of the Pressed Metal Co., Pittsburgh, died October 25 at the age of 71.

THOMAS DE COURSEY RUTH, vice-president of Robert J. Emory & Co., Newark, N. J., builders of wire winding machinery, died Oct. 27 at the age of 64.

NELSON C. SPENCER, president of the Spencer Air Conditioning Co., Buffalo, died October 25 at the age of 66.

• MEETINGS •

AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Annual meeting, New York, Dec. 4-8. CALVIN W. RICE, secretary, 29 West 39th St., New York, N. Y.

NATIONAL FOUNDERS ASSOCIATION. Thirty-seventh annual meeting. Nov. 15-16. Hotel Waldorf-Astoria, New York. J. M. TAYLOR, secretary, 29 South La Salle St., Chicago, Ill.

SOCIETY OF AUTOMOTIVE ENGINEERS. Annual dinner, New York, Jan. 8. Annual meeting, Detroit, Jan. 22-25. JOHN A. C. WARNER, secretary, 29 West 39th St., New York, N. Y.

American Machinist
REFERENCE BOOK SHEET

Machining Non-Metallic Materials—III

Fiber

TURNING—Fiber is an extremely hard and tough material, and to obtain the best results in machining it is necessary to keep the cutting edges of tools in good condition. The material is slightly elastic and tends to impinge against the back of the tool and to generate heat. As a general rule, tools for cutting fiber should be ground about the same as for cutting brass. The peripheral speed should be about 30 per cent faster than for cast iron, using a coarse feed and a wide-nosed tool. Large clearance but no rake should be employed. Lubricant is not needed. Diamond cutting tools are satisfactory for light cuts on close work.

Fiber tubes and rods can be successfully machined in automatic screw machines or hand turret lathes. When tubes of the correct size can be secured they will generally give better results than rods. The following are the recommended cutting feeds on automatic screw machines:

Drilling	0.007 to 0.010 in. per rev.
Turning	0.010 to 0.015 in. per rev.
Forming	0.0015 to 0.002 in. per rev.
Cutting-off	0.002 to 0.003 in. per rev.

THREADING—Both solid and self-opening dies are used, but the self-opening type is recommended for all work except that with short thread lengths where the threads may be torn off in opening the die. A smoother thread is obtained by stoning the dies to a negative rake of 7 deg. and slightly dulling the cutting edge with a V-shaped stone. Tap drill holes should be made from 0.002 to 0.006 in. larger than commonly specified when tapping brass or steel. In selecting the tap drill it should be remembered that a drill will cut fiber a few thouandths smaller than itself unless ground slightly off center. A very little oil will give an easier flow of chips.

DRILLING—Run drills at the highest speed possible without burning the tool. A ¼-in. drill should run at 2,500 r.p.m. and a No. 60 drill at 10,000 r.p.m. High-speed or special bakelite drills with greater spiral, narrow web, and wide flutes are recommended. The drill should be ground with a liberal clearance and should not be forced. Fiber should always be drilled perpendicular to the grain when possible. Ordinarily a drill cuts smaller than itself in fiber, making the hole a few thousands smaller than the drill. This may be overcome by grinding the drill slightly off center. Digging in may be minimized by stoning the cutting edge to give it a slight negative rake.

MILLING—With standard milling cutters high speeds and feeds give the best results both as to finish and length of time between grinds. Two-bladed fly cutters for form work should be run at higher speeds but with slower feed. A high speed and coarse feed will throw the chips away from the work and will prevent a rubbing action that dulls the tool quickly. For deep slots use side-milling cutters because fiber will bind if straight-side cutters are employed.

SAWING—A smooth polished edge can be obtained with a hollow ground circular saw without set to the teeth. A satisfactory circular saw for stock up to ¼ in. is 14 in. in diameter, with 110 to 120 teeth, and from ⅛ to 3/32 in. thick at the outer edge. This saw should be run at 2,500 to 3,000 r.p.m. Bandsaws with 5½ points per in. and 19-gage thickness are satisfactory. The widths vary from ¼ in. for scroll sawing to 1¼ in. for heavy sheet sawing. A bandsaw should run at about 4,000 ft. per min., and will last from 1 to 1½ hr. on ⅛-in. fiber, and ½ hr. on ¾-in. fiber before sharpening is necessary.

BENDING AND FORMING — Fiber should always be bent parallel to the grain (long way of the sheet), because it is difficult to bend fiber across the grain without breaking. It is general practice to soften the material by immersing in hot or cold water and then drying it out in heated forms under sufficient pressure to keep the shape desired. If the material can be steamed instead of immersed, it will require less time to set.

PUNCHING—Blanking, piercing and shaving operations on fiber can be done with ordinary punch presses. The punches should be a close fit in dies for best results. Fairly smooth edges can be obtained in stock up to ⅛ in. thick without heating. Above this thickness it is advisable to heat the stock to 180 deg. F. When a rough edge is not objectionable thicknesses of ⅜ to ½ in. can be punched. Because of the necessity for frequent grinding, dies for fiber should not have any taper clearance. In rough punching when accurate dimensions are required allowance should be made for the punch to produce a hole 0.001 in. to 0.008 in. smaller than itself and for the blank to be 0.001 to 0.0008 in. larger than the hole in the die plate, the allowance increasing with the thickness of the stock.

SHAVING — The cutting edge of shaving dies should be about 45 deg. No clearance is given to the first ¼ in. of the die, and dies can be ground without changing size. A better edge on the part can be had by using a roughing cutter and then a finishing cutter. Fiber has a tendency to check. Elimination of the difficulty will be obtained by heating it to 180 deg. F. If the cutting edge on a shaving cutter is mouthed out very slightly with an oil stone, the stock will bind slightly in passing through, will prevent chatter, and will tend to smooth and polish the edges. Stock up to 1¼ in. thick can be smooth punched by successive shaving operations.

Courtesy of the Continental-Diamond Fibre Company and the Spaulding Fibre Company

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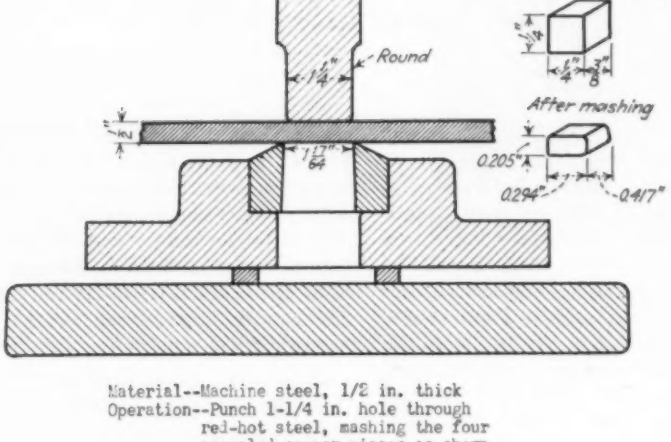
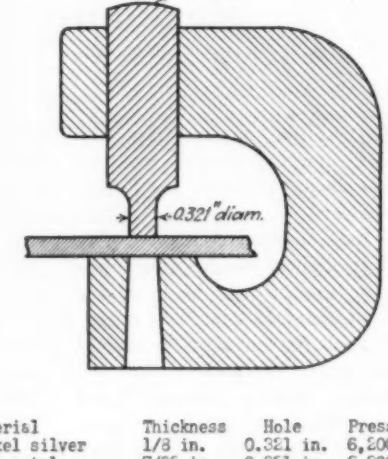
Press Work Pressures

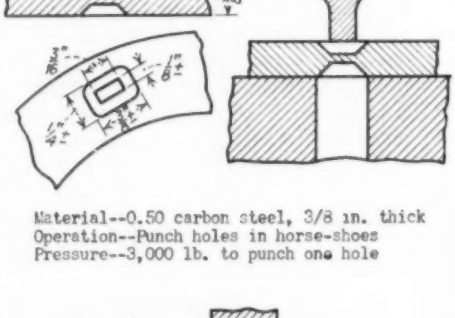
Series XX—*Punching*



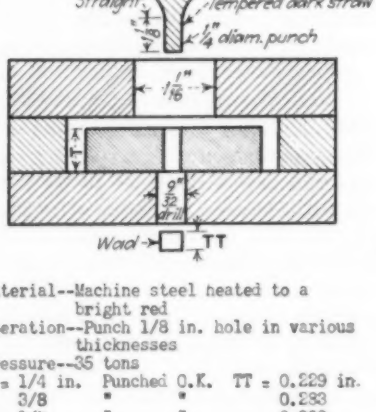
Material--Machine steel, 1/2 in. thick
Operation--Punch 1-1/4 in. hole through red-hot steel, mashing the four annealed copper pieces as shown
Pressure--19,000 lb. Pressure required to punch 1-1/4-in. hole in cold machine steel - 118,000 lb., or about six times the pressure required to punch it hot



Material	Thickness	Hole	Pressure
Nickel silver	1/8 in.	0.321 in.	6,200 lb.
Type metal	7/32 in.	0.321 in.	2,200 lb.
Copper	1/4 in.	0.321 in.	5,900 lb.
		0.642 in.	11,300 lb.
Steel, low carbon	0.026 in.	0.321 in.	1,000 lb.

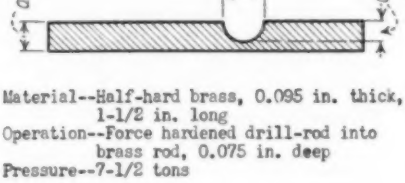


Material--0.50 carbon steel, 3/8 in. thick
Operation--Punch holes in horse-shoes
Pressure--3,000 lb. to punch one hole

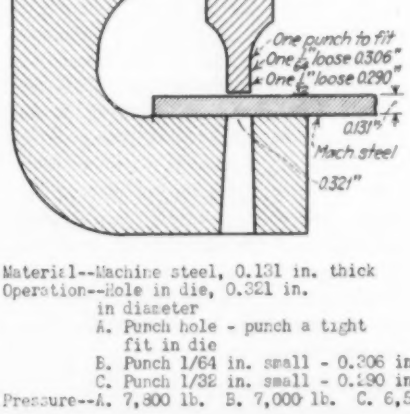


Material--Machine steel heated to a bright red
Operation--Punch 1/8 in. hole in various thicknesses
Pressure--35 tons

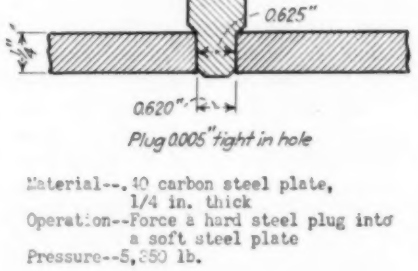
T =			
1/4 in.	Punched	O.K.	TT = 0.229 in.
3/8	"	"	0.283
1/2	"	"	0.300
5/8	Bottom corner of punch began to round off		0.311
3/4	progressively for in-		0.321
7/8	creasing depth		0.312
1			0.300



Material--Half-hard brass, 0.095 in. thick, 1-1/2 in. long
Operation--Force hardened drill-rod into brass rod, 0.075 in. deep
Pressure--7-1/2 tons

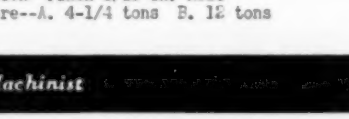


Material--Machine steel, 0.131 in. thick
Operation--Hole in die, 0.321 in. in diameter
A. Punch hole - punch a tight fit in die
B. Punch 1/64 in. small - 0.306 in.
C. Punch 1/32 in. small - 0.290 in.
Pressure--A. 7,800 lb. B. 7,000 lb. C. 6,500 lb.



Plug 0.005" tight in hole

Material--.40 carbon steel plate, 1/4 in. thick
Operation--Force a hard steel plug into a soft steel plate
Pressure--5,350 lb.

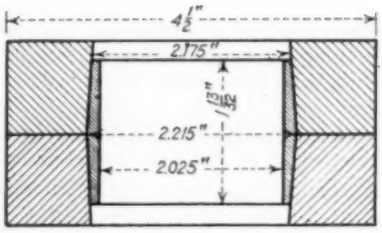


Material--A. Soft machine steel, 5/32 in. thick
B. 0.40 carbon steel, 7/32 in. thick
Operation--Punch 5/16-in. hole
Pressure--A. 4-1/4 tons B. 12 tons

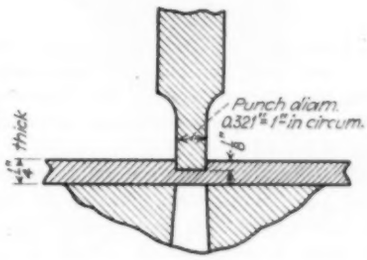
Contributed by C. W. LUCAS *American Machinist*

Press Work Pressures

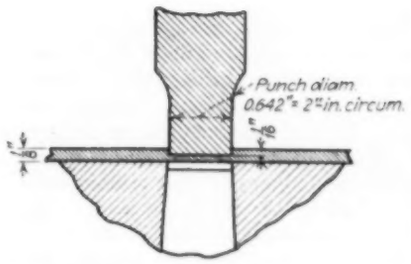
Series XX—*Punching*



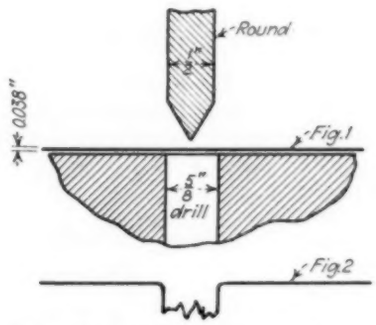
Material--Malleable iron nipples
Operation--Punch forced through nipple, making wall thinner
Pressure--35 tons
3,600 lb. required to strip nipple from punch
12,000 lb. required to eject nipple from dies



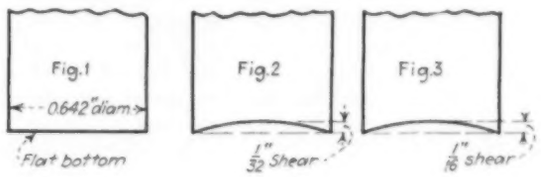
Material--Machine steel, 1/4 in. thick
Operation--The maximum pressure in punching is just as the punch gets half-way through the metal to be punched, in this case 1/8 in.
Pressure--12,600 lb.



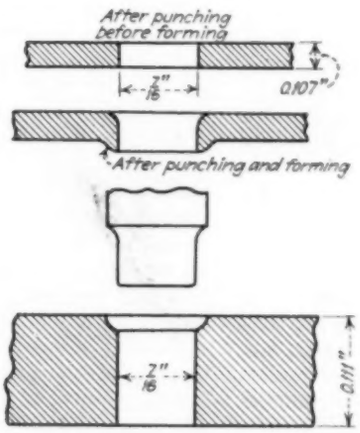
Material--Machine steel rod, 1/8 in. thick
Operation--In punching a 1/8-in. rod the maximum pressure occurred when punch entered the bar 1/16 in.
Pressure--12,050 lb.



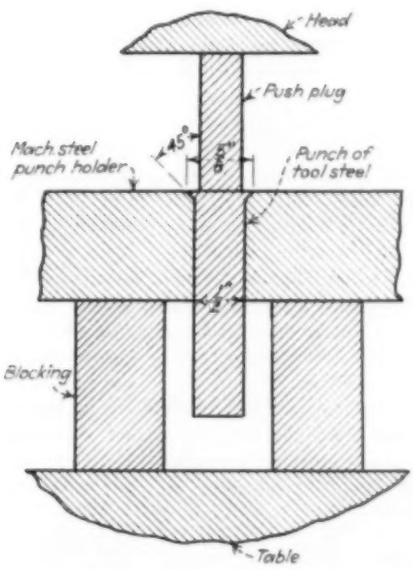
Material--0.40 carbon steel, 0.038 in. thick
Operation--Punch a 1/2-in. round hole; metal left as in Fig. 2
Pressure--450 lb.



Material--Soft steel, 1/16 in. thick
Operation--Punch a 0.642 in. hole
A. Bottom of punch flat and die flat
B. With 1/32-in. shear to the punch and die flat
C. With 1/16-in. shear to the punch and die flat
Pressure--A. 5,600 lb. B. 5,500 lb. C. 3,800 lb.



Material--Soft sheet steel
A. 0.107 in. thick B. 0.111 in. thick
Operation--Punch a hole, form a bead on bottom and countersink
Pressure--A. 4-1/2 tons to punch, 5-1/2 tons to form bead and countersink
B. 3-1/10 tons to punch, 5-1/2 tons for bead and countersink



Material--Tool steel punch
Operation--Force punch down through punch holder
Pressure--6,900 lb.

Contributed by C. W. LUCAS

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Threading Lobes on Screw Machine Cams

C. W. HINMAN

Taps and dies for automatic screw machines are mounted in a block that slides in a positive holder, with a coiled tension spring attached behind the block. This arrangement allows the cutter to advance slightly ahead of its holder by pulling on the spring while being lead by the revolving work. The holder is positively secured in the turret and is advanced slightly behind, but following the threading tool, by a lobe on the lead cam. This precaution prevents the cam from crowding the cut and spoiling the work.

Actual practice, has determined this cutter advance to be 12½ per cent ahead of the corresponding cam rise. This allowance is easy to obtain when designing the cam lobe, by using a rise for a thread which has a lead 12½ per cent, or ⅛, less than the thread lead on the work. The procedure for the lobe design is simple and involves no tedious graphical layouts.

An example would be cutting 32 threads per in. for a distance of ¾ in. Take the thread lead or 0.031 in. and deduct from it 12½ per cent or 0.004 in. which leaves, 0.027 in. This latter lead is used when computing the cam rise. Since the number of spindle revolutions for threading with the lobe are the same as the number of threads to be cut, plus four (four revolutions added to clear the work when approaching and leaving) and the number of revolutions required are determined by dividing the travel by the feed per revolution, we compute as follows: Dividing 0.750 in. by 0.027 in., gives 28 revolutions, and adding 4 gives 32 spindle revolutions, for threading with the cam lobe. It is obvious that while the tap or die is being lead to cut a distance of 0.031 in. at each revolution of the work, that the tool holder normally travels but 0.027 in.

The height of the cam throw must be 10 per cent less than the length to be threaded. In our example, we must include the four extra revolutions, so the length becomes ⅞ in. Next deduct 10 per cent and the required throw is 0.788 or approximately ¹³⁄₁₆ in. This computation favorably changes the tool holder travel from the normal figure 0.027 to 0.025 in. per revolution.

The standard Brown & Sharpe No. 00 automatics, have no back rod by which spindle speeds can be controlled in the overhead works. The No. 0 and No. 2 machines have these back rods, and when not used for changes from maximum to minimum speeds, the threading lobes for all three machines are similarly designed.

The contour of the rise on threading lobes can be a spiral, similar to that used on regular cam rises. Some threading lobes however, have a lead in one turn so great, that spiral rises are impractical to make. Spiral rises can be used on threading lobes if we have based the rise, the throw, and contour design on the foregoing methods. The follower roll necessarily assumes a gradually increasing clearance relative to the lobe when using a spiral rise.

When impossible to use a spiral rise, substitute the arc of a circle, scribed with a radius equal to the distance from the highest point of the lobe, to the center of the cam, and then deduct 10 per cent.

For the number of revolutions in the layout for threading on, when a back rod shift is not used, divide the fast spindle speed by the slow, and multiply the quotient by the number of revolutions for threading off.

When threading on the No. 0 and No. 2 automatics, it often occurs that the fast spindle speed is the highest given in the column on the belting diagram, yet gives the correct number of surface ft. per min. for the machining operations. The next lower, or the intermediate speed, is too fast for threading, while the lowest speed in the column is the one desired. In such cases the back rod on the machine is resorted to for shifting belts in the overhead works from high speed, passing the intermediate speed, and obtaining the lowest r.p.m.

This change has a direct influence in computing the threading-off lobe. It does not affect any of the foregoing rules for obtaining the rise and throw, nor for determining the number of revolutions on, in the layout, nor the methods for obtaining the lobe contours.

What happens is that just previous to threading on, the back rod shifts the belts from fast to slow speed with the same results as previously described, but when the follower roll is above the highest point on the cam lobe, and the threading is finished, the spindle is reversed by its friction clutch, instead of using the back rod shift, and threading off is accomplished at the intermediate speed. Therefore the number of revolutions for threading off, in the layout, are determined by dividing the fast speed by the intermediate speed, and multiplying the quotient by the number of revolutions for threading on.

Formulas for calculating threading lobes when back rod is used

Let F = r.p.m. of fast speed. S = r.p.m. of slow speed.
I = r.p.m. of intermediate speed. R = revolutions—threading off.
r = revolutions—threading on.
N = number threads to be cut plus 4, lead reduced 12½ per cent.

$$\text{Then } R = \frac{F}{I} \times N \quad r = \frac{F}{S} \times R$$

If T = cam throw, n = number of threads on the work,
and L = Lead of threads on work,
Then $T = L(n + 4) - 10$ per cent.

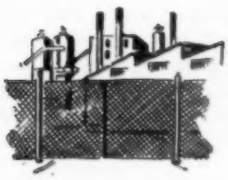
Press Work Pressures
Discussion

M. P. DALTON
St. Anne's, Kent, England

Referring to the data in an article by C. W. Lucas under the title given above (*AM*—Vol. 77, page 506), it seems to me that the pressure for coining the celluloid part shown in the upper left-hand corner is excessive. If the celluloid had been softened in warm water, the pressure would have been much less than that given.

Also, the punch should be provided with an air vent. Otherwise unsightly marking might be made by any impurity present. Even a drop of water would indent the celluloid considerably. While an air vent in the punch would leave a teat on the work, the teat could be removed but an indentation could not.

Heating celluloid for press work is more or less dangerous on account of the inflammability of the material. It is not generally known that there is an entirely safe way of heating the tools, and it is faster than heating the blanks. If the tools are insulated by sheet fiber and fiber bushings are used in the bolt holes, the tools can be cheaply heated by passing a low-voltage current through them. A 12-volt accumulator of large size is usually suitable, but a current of 30 volts can be safely used with ordinary insulated flex coiled in spring fashion.



Moving Again

"Well, Ed, I'm up against the same old proposition."

"What old proposition?"

"Changing things around to provide greater manufacturing space."

"You're not kicking about that, are you?"

"No, but I'm not so awfully keen about increasing the size of our factory again. I'd rather have a small factory with plenty of business than a big one without enough work to fill it."

"You're lucky, boy, to have to expand in times like these. Did the NRA do it?"

"No. I don't know, of course, how much it may have helped our customers. It may have caused them to order more compressors, but directly, it has not affected us, that I can see."

"How much are you going to expand? Going to move again?"

"No, we'll just expand into the older section of the plant. We took an option on it when we bought our present factory. As a stockholder, you will get a letter soon, asking for your approval."

"What if I vote 'no'?"

"It won't make much difference if you do, unless Mason or I vote with you, but we'd rather have your approval."

"Oh, you have it. You've done pretty well, so far. How many more men will you hire, under the new plan?"

"About twenty, I guess. That's the trouble, I don't know just how far ahead to plan. We don't want to buy any more space than is necessary, or buy a whole lot of equipment that will not be fully utilized."

"Why worry? If you keep on growing the way you have, you will need a city block in a few years."

"I'm not worrying about the future. It is the present that bothers me. How big a bite shall we take now, and how soon will we have to expand again?"

"Rather poor planning in the beginning, wasn't it, Al?"

"I don't think so; we planned for a hundred per cent increase in five years. We've increased 150 per cent in less than two years."

"Yeah, but as I said before, why worry about that?"

"I have many worries about things as a manager, that never bothered me as a foreman, and believe me they are worries."

"For instance?"

"Well, we can't afford to buy more space and then find out that we must expand again soon. We'll need a larger factory and I don't know where to get one. Besides, we may want to build our own plant, somewhere else; I don't favor big plants in small towns. An industrial city is not usually a good home town."

"What do you mean, a good home town? Isn't this a good home town?"

"Yes, but it wouldn't be if it had several big factories."

"What would you do, build in the country?"

"Yes, I'd build outside of town, on some railroad of course, and let each man have a small farm or plot of land. Then, if they were laid off they would be in better shape to take care of themselves."

"How'd they get the farms, would you give 'em to them?"

"No, we couldn't afford that, but we could organize a building and loan association and sell the land at nearly cost."

"What would you do about schools? You'd have to build one, wouldn't you?"

"No. The present county system furnishes buses for school children. We wouldn't be bothered that way."

"How big a plant would you build?"

"That's what I'm trying to figure out, and whether to build at all. We're sitting on top of the world just now, and building will put us in the hole. I wish I were a foreman again."

What is the best policy for Al to follow, buy more space or build?

If he builds, is a city or country location preferable?

Discussion

The Buyer

Al's statement to the effect that, "purchasing agents usually get in their bids, place their orders, and then heave a sigh of relief and sit back until time to place more orders," is of course true of some. Such usually buy at the lowest bid submitted, even as Al himself takes the opposite course and buys at the highest price. Anyone not actually half-witted can follow either of these two courses, but either will fall far short.

Instead of loading stores-keeping on a purchasing agent, it would be better to leave him free to check the utility of the material he is buying. In order to do a real good job of that, he will have to be something of a mixture between an engineer and an economist. It is being appreciated more and more that there is decided room for correlation between

buying and engineering, and if the buyer is not a man with an engineering viewpoint, he should at least be entitled to a free exchange of ideas between himself and the engineer.

Nor can the relation of buying to current sales volume be safely overlooked, if he is to buy with the idea in mind of promoting a reasonably rapid turnover. This means that he must be able to have time to contact the sales department as well as the engineering department, besides doing a certain amount of "nosing around" and fitting himself to buy not only on price, but with all of the factors reasonably well figured in.

—JOHN E. HYLER.

One Channel?

Al's chief reason for wanting to deal through one channel is to save the bother of interviewing salesmen. He probably does not realize that every salesman he interviews renders him a valuable service and, whether or not he deals with the caller, he obtains a general survey as to the items the salesman is trying to sell. Today, nearly all salesmen are technically trained in the various processes of manufacture of their goods, about which they are only too willing to give valuable information. It is obvious that nothing is to be gained by barring salesmen, but conversely, valuable ideas and information may be gained by allotting them sufficient time to tell their stories.

Al should also remember that in his company's interest it is his duty to purchase all needed supplies and machinery of suitable quality as cheaply as possible. If he deals through one channel he will probably be misled at some time or other, but if he obtains full data from each salesman on a particular item before he buys, he will know that he has fulfilled his duty. —E. V. PIRANIAN.

Thirty-Hour Week

To the machinist who is alive, the 30-hour week would be as a new lease of life, the forgiveness of sins, or as an answer to the fervent prayer of a righteous man, providing, of course, that he still got the 40-dollar-per-week pay check.

The extra hours of leisure would miss the mark unless there were dollars that could be spent to provide the tools of leisure. More machinists would find time to read the *American Machinist* if they had the money for the subscription price, and nearly all of them could spend some of the extra hours in improving their education. There are lots of real machinists who haven't a decent kit of tools or more than one suit of good clothes.

If more money were spent for automobiles or shoes or books, or a million things that every man, woman and child needs, more workers would be required to supply their wants, and in this way the unemployed would find employment. But these things can never be unless we have a system whereby no one can get rich without creating the wealth by his own labor. —C. D. MICHENER,
Diamond Drill Contracting Company

Thirty-Hour Week

Al's objection to the thirty-hour week is weak. If he has not built up an organization in his plant that could carry another shift, it is poor management on his part. What would become of his plant and the rush work if he were taken sick? It looks as though he would have to shut down.

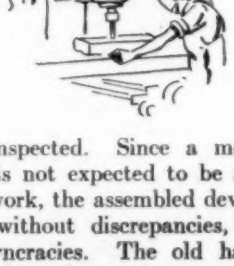
If each employee gets a comfortable living wage and is assured steady work for thirty hours each week, Al may rest assured that the majority of his men will be able to take care of their leisure time, as they have had a great many more leisure hours in the past three years than in any like period before.

Double shifts and night shifts have their handicaps in industries, but they can easily be overcome by proper and efficient planning.

—HARRY A. GILLILAND,
Hamilton, Ontario, Canada

Doing Without

So long as the human element remains in pride in workmanship, where a man's digestion; baby's new tooth; the wife's desire for a new hat; and sundry other items affect it as they do that pride in workmanship does not deserve the same type of implicit faith that is given to the readings of vernier calipers. Parts that must fit with precision should be



rigidly inspected. Since a mechanical product is not expected to be a matter of guesswork, the assembled device must operate without discrepancies, vagaries or idiosyncracies. The old hand-craft methods are now obsolete, and demands for "split-hair" precision have made inspection necessary.

Meanwhile, what of Al's proposed plan to obviate the necessity of inspection? While his reasoning is sound, his proposed system is likely to be a failure from the start. Perhaps Al can get by with his three-point plan, but he will succeed far better if he uses his three points to simplify and expedite inspection, rather than to obviate its necessity. Self-inspecting fixtures; processes that correct preceding errors; and labor value added to mechanical work are decidedly worthwhile ideas in themselves. Yet they are not qualified to entirely do away with the need for accurate inspection of all articles where labor peculiarities are coupled with machines that can develop unexpected defects.

—FRED BENNETT,
Superintendent, Standard Products Company

In a small shop, especially if manned by high grade mechanics, inspection can be left to the foreman. Except in large plants, engaged on interchangeable manufacture, I believe that inspection can be overemphasized.

As operator of a small specialty shop and buyer of a diverse line of both commercial and custom built precision scientific apparatus, I have noted that high grade workmen, paid on a salary basis, turn out work requiring a minimum of inspection, whereas purchased material, supposedly thoroughly inspected during manufacture and after completion, frequently exhibits defects which should have been easily detected by the makers.

"Thoroughly inspected during manufacture" may be good copy for the advertising man and for the sales department but is not necessarily indicative of perfection in the product.

—DOUGLAS L. PARKHURST,
Chief, Instrument Division, U. S. Coast and Geodetic Survey.

Al seems to think that because he is running a small shop he can get along without many things that are essential in a large plant. In some instances he is right, but when he makes no provision for inspection, he is heading straight for trouble. Without inspection, the component parts of no two compressors will be alike, and Al will be unable to furnish repair parts that will fit.

The idea of having one operation correct a possible error in a preceding one is all right if one compressor only is to be made, or if replacement parts will never be needed; otherwise inspection is necessary.

In such a small plant, the inspection work will probably not require the full time of one man, so that he can do other work, thus keeping down the cost of inspection. One faulty compressor delivered to a customer could easily cost Al more than a month's pay of a part-time inspector. —C. J. MORRISON.

• IDEAS FROM PRACTICAL MEN

Replacing a Faulty Chuck

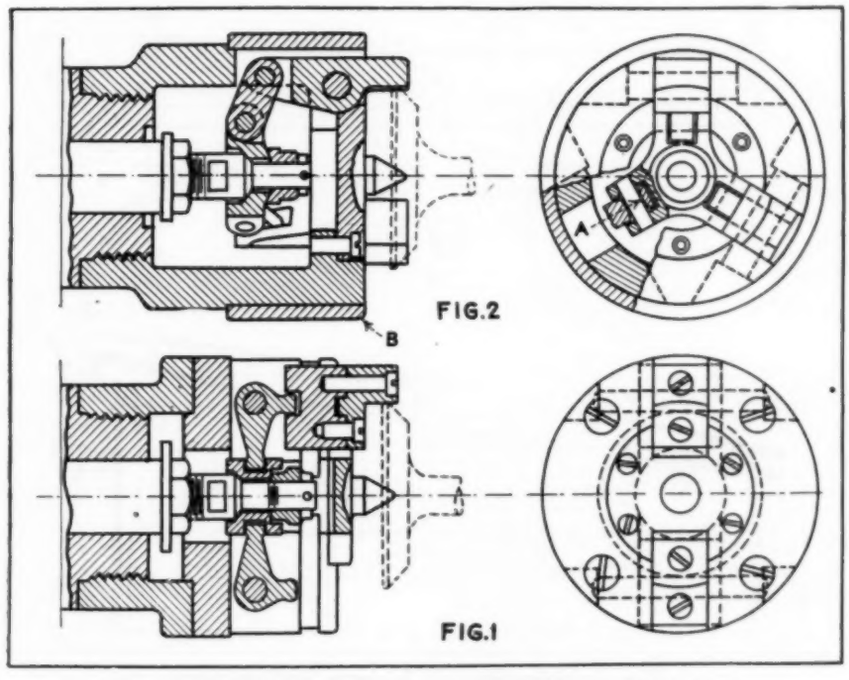
ALFRED M. WASBAUER

At first glance, the two-jaw air operated chuck illustrated in Fig. 1 appears to be all right. If it had been used for work that ran true and where the cuts and the feeds were light it might have been satisfactory. But our work did not always run true and the cuts and the feeds were comparatively heavy. The jaws slipped on the work and the overhanging part of the work was thrown out of true.

The first fault in the design of the chuck is that it has but two jaws. The second fault is that the bearings of the jaws on the face of the chuck are too short for the outward reach of the jaws, permitting them to cock. The result was that much of the pressure that should have been used to grip the work was lost in friction. As the bearings of the jaws gradually wore in one spot, this condition became so aggravated that the chuck was useless.

The chuck was replaced by the three-jaw chuck illustrated in Fig. 2. This chuck overcame all the difficulties, permitting heavier cuts and feeds. Because of its three gripping points and because nearly all of the pressure applied was effective in gripping the work, it prevented the work from slipping.

In making this chuck, the linkage must be free in the slots and the holes for the link pins must be curved, as indicated at *A* in the part sectional view at the right. The outer ring *B* is desirable to provide a smooth exterior.

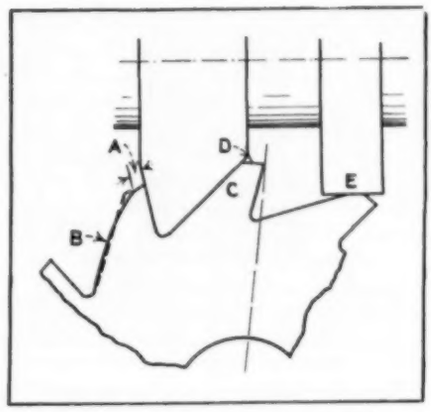


The three-jawed chuck shown proved much more satisfactory for work with heavy cuts and feeds than one with two jaws

Simplified Milling Cutter Layout—*Discussion*

FRANCIS W. SHAW
Heywood, Lancashire, England

In an article under the title given above (*AM*—Vol. 77, page 461), Victor J. Smith tells how to lay out a milling cutter having parabolic teeth. But is the parabola the correct shape for cutter teeth. From one point of view the answer might be yes, for the parabola theoretically permits the teeth to yield from top to bottom by an amount proportionate to their strength, so that, as it were, they don't know where to start



Different forms of cutter teeth

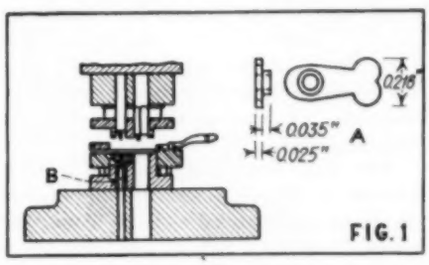
to break. But if experience dictated the reply, the answer might be no, for teeth are apt to chip at their sharp points, implying that they ought to be strengthened there.

Referring to the illustration, if the width *A* be increased, the circular arc *B* by which Mr. Smith has approximated the parabola calculated by the formula in the cited A.S.M.E. Transactions, would become so straight that in the interests of production it might just as well be straight. This done, the tooth will be of the form at *C*. Should this form necessitate excessive top relief at *D*, it would be a simple matter to bevel the corner as at *E*, leaving *A* a little wider than is shown.

Developing Press Tools

E. BELL HARE

The press tools illustrated in Fig. 1 gave considerable trouble in making the part *A* on a high-production basis. The part was made from deep-drawing brass $\frac{1}{8}$ x 0.025 in. and a roll feed was used, the stock being fed from left to right. Piercing and drawing were both done at the first station; blanking at the last. The trouble was mainly due to the small



In this design the slugs were caught by oil in the channel

slugs being caught in the channel *B* because the oil used for lubrication tended to make them stick tightly together and clog the channel. These tools were discarded.

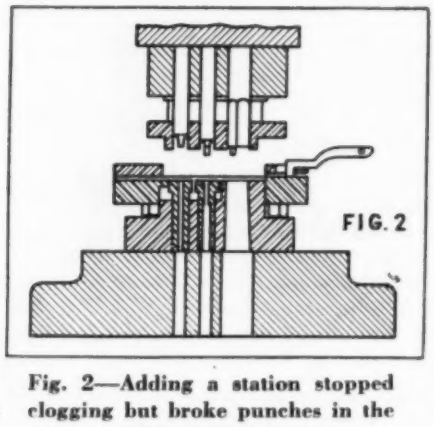


Fig. 2—Adding a station stopped clogging but broke punches in the first operation

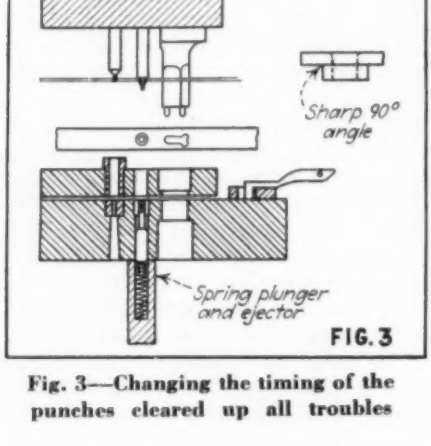


Fig. 3—Changing the timing of the punches cleared up all troubles

In the second stage of development, shown in Fig. 2, one station was added, cutting down the function of the first station in Fig. 1 by one-half. Piercing a locating hole was done at the first station; drawing at the second; and blanking at the third. These tools gave trouble, not from the slugs clogging the channel, but by breakage of the tip of the punch at the first station, due to the punches entering the stock at practically the same time. Not enough stock was allowed between the punches for drawing, and the resultant pull of the stock caused the tip of the punch to break. Another disturbing factor was that the extruded portion of the part was sometimes caught in the extruding channel, preventing feeding to the blanking station.

The final development of the tools is shown in Fig. 3. The timing of the punches was changed and the blank was pushed entirely out of the die by a spring-operated ejector, leaving the extruding channel clear. Drawing took place at the second station before the punch at the first station pierced the locating hole, thus overcoming breakage of the piercing punch. Also, at this station the extruding punch seated quite firmly and smashed the stock so that a sharp right angle was made by the extruded portion of the part. This sharp angle is necessary in the assembly of the part in its designated position in relation to other parts of the mechanism of which it is a member.

Machine for Sorting Disks

VINCENT WAITKUS
Vincent Waitkus & Sons Company

In manufacturing disks similar to the one shown at *A* at the rate of about a million per day, it was not uncommon to find considerable irregularity in their thickness, necessitating some rapid means of assorting them. Therefore, the machine illustrated was designed.

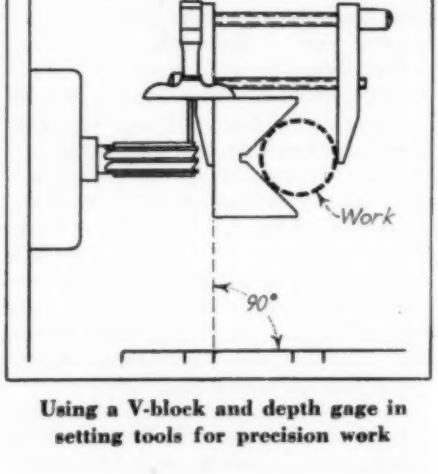
Two rollers of heavy tubing and machined to a slight taper are mounted at an angle to the horizontal, the larger diameters being at the high end, and are driven by a motor through worm gearing. Spur gears on the shafts of both rollers cause them to revolve in opposite directions, the upper surfaces moving away from each other. Means for feeding the disks to the rollers consist of the hopper *B* and the oscillating chute *C*. While the oscillating mechanism is not shown, it is connected to the rocker arm *D* and the oscillations are very short and rapid.

The operation is very simple. The disks fall from the chute onto the rollers, assuming an on-edge position due to the cylindrical surfaces of the rollers. The disks roll down between the rollers by gravity until they reach a point where they can fall through the gap between the rollers and into receptacles below. Since the gap between the rollers gradually widens toward their lower ends, the thin disks fall through first and the thicker ones later. As the rollers are driven in opposite directions, as indicated by the arrows, the direction of rotation prevents the disks from being jammed between them.

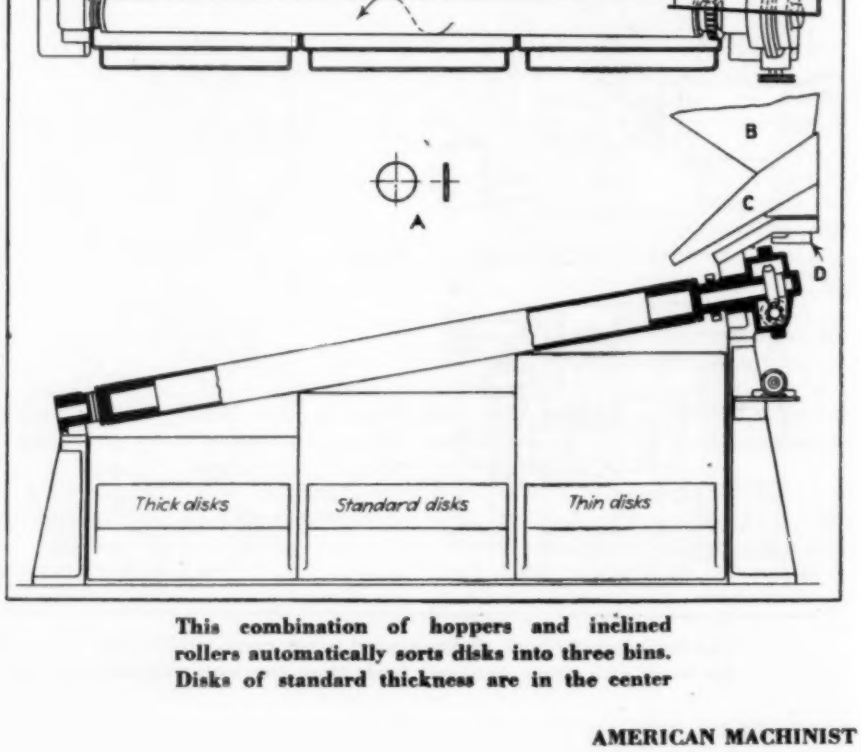
Setting Tools Accurately

PETER L. BUDWITZ

It is often necessary to set an end mill, drill, or other tool accurately in the center of cylindrical work when cutting slots or drilling holes. Because of



Using a V-block and depth gage in setting tools for precision work



This combination of hoppers and inclined rollers automatically sorts disks into three bins. Disks of standard thickness are in the center

the curved surface of the work, measurements are difficult to make. The kink illustrated overcomes this difficulty and is particularly useful when the work is held between the index centers of a milling machine.

An accurate V-block is clamped to the work, as indicated in the illustration, the bottom of the V-block being set square with the table. It is obvious that measurements can now be made with a depth gage. Assuming that an end mill is to be set central with a cylindrical piece. It is first set as nearly as is possible by the eye. The depth gage is then used, first on the upper part of the V-block and a measurement is taken to the tool. The depth gage is then transferred to the lower part of the V-block and a measurement is taken to the tool from that point. Any difference in the two measurements can be readily compensated for by raising or lowering the knee.

I have used this method successfully in making horning dies and other work of a similar nature.

Safety Device for Forming Dies

WILLIAM GRAY

In a certain tin-can factory, all the presses are equipped with the usual safety devices and, in adition, all forming dies have safety slides similar to the one illustrated, so that there is no necessity for the operator to put his fingers in the danger zone.

The blank to be formed is placed in the sliding half-nest *A* and the slide is pushed to position *B* by the knurled pin *C*, carrying the blank to the other half *D* of the nest. Here the blank drops on two pilot pins which engage holes in it and hold it in position. When the operator lets go of the knurled pin, the sliding half-nest is returned to its former position by a spring, not shown. After the blank has been formed, it is blown off of the die by compressed air.

When blanks have no holes in which pilot pins can engage, the forming die is provided with a complete nest into which the blank drops when pushed by the slide. The stationary parts of the slides in this plant are usually not less than 12 in. in length and are attached to the dies or the die-shoes, as is most convenient. While these slides increase the cost of the tools, their use has decreased the number of accidents in this plant.

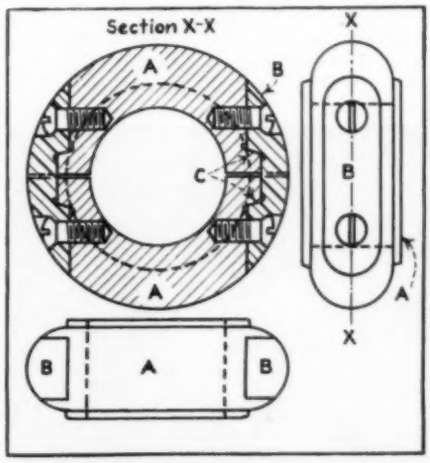
Split Set-Collars

J. T. TOWLSON
London, England

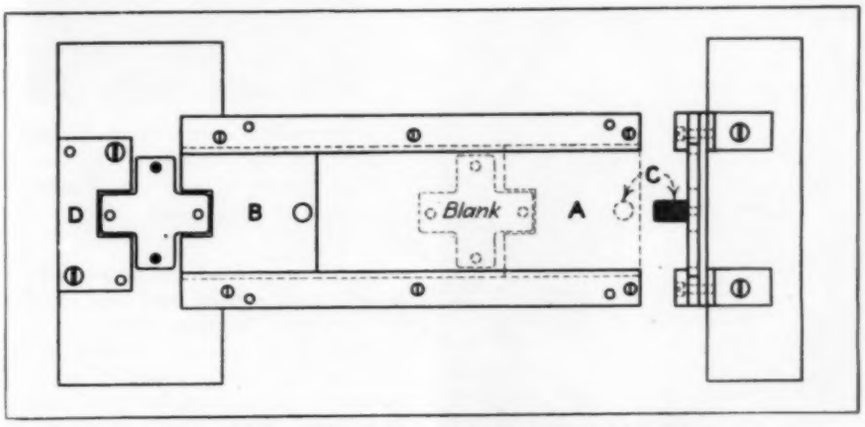
In visiting an engineering plant, I saw some split collars that interested me. The collars, one of which is illustrated, were made of cast iron and had malleable-iron clamps on each side. Referring to the illustration, the collar is shown at *A* and the clamps at *B*. Tapered lugs cast on the collar engage tapered recesses in the clamps. In addition, the clamps fit between cheeks in the rim of the collar, so that after the collar has been split the halves will be kept in line. No machining of the lugs and the recesses was necessary, the patterns being carefully made so that the joints *C* fitted well. The clamps had deep countersinks for guides in starting the body size holes for the screws.

Other than drilling the clamps and drilling and tapping the collars for the screws, the only machine work required was to bore and face the collars. The collars were bored a few thousandths under standard size so that after they were split the halves would grip the shaft tightly. After tapping the screw holes and boring and facing the collars they were split with a 0.040-in. thick slitting saw. Attaching the clamps with the screws completed the job.

The designer claimed that the tapered lugs and recesses provided excellent means for gripping the halves of the collars tightly on the shaft, taking the burden off of the screws, the only duty of which was to hold the clamps in place.



This collar will grip the shaft tightly and the halves will stay in line



Here a sliding pusher feeds the blanks under the punch and keeps the operator's hands out of all danger

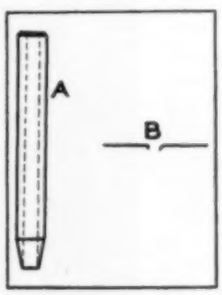
Drills for Thin Sheet Metals
Discussion

CHARLES DOESCHER

Referring to the article by H. E. Fick under the title given above (*AM*—Vol. 77, page 442), if Mr. Fick will cut the holes with a punch such as is shown at *A* in the accompanying sketch, he will find that he can not only do a quicker and neater job than by drilling, but that all the holes will be round and of the same size.

The punch can be easily and quickly made of drill rod, the size of the hole in the punch governing the size of the hole to be punched. The punch is used in connection with a block of "dead soft" machine steel that has been planed on one side, and upon which the metal to be punched is laid. One light blow with a hammer will do the job.

If the edge of the hole is to be rounded, as at *B*, a hardwood block should be used instead of the one of machine steel.



This punch is used instead of a drill for very thin metal

SHOP EQUIPMENT NEWS

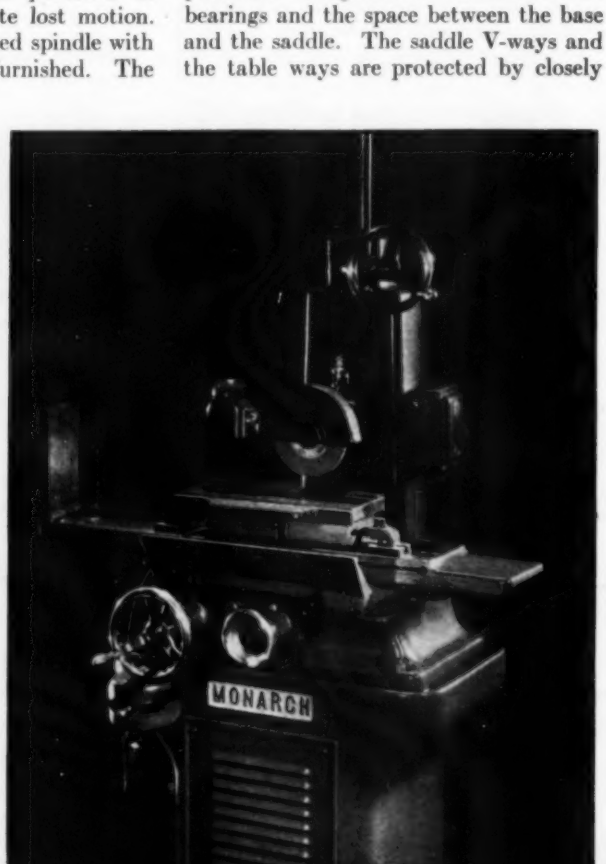
Monarch Precision Toolroom Surface Grinder

Table traverse effected by an adjustable roller chain and sprocket is an innovation in the hand-feed, precision toolroom surface grinder announced by the Monarch Machine Tool So., Sidney, Ohio. The sprocket is mounted on a splined shaft which is geared to the traverse handwheel shaft. The chain is pinned to one end of the table and a convenient adjustment is provided at the other end to eliminate lost motion. An inbuilt, motor-connected spindle with anti-friction bearings is furnished. The unit is balanced and bearings are protected against abrasives and foreign substances. It is furnished by the Ex-Cell-O Aircraft & Tool Corp., Detroit.

Automatic forced-feed lubrication is used for all bearings, except the spindle bearings, which require special oil. Protection of sliding surfaces from abrasives is attained by a system of flat steel pieces for the spindle carrier and column bearings and the space between the base and the saddle. The saddle V-ways and the table ways are protected by closely fitting drawn-steel angle pieces. Large area (75 sq.in.) of lubricated bearing surfaces between the spindle carrier and column prolongs the accuracy of the machine. An adjustable nut on the spindle elevating screw compensates for wear and eliminates backlash. The spindle elevating handwheel is graduated from 0.0005 in.

Specifications: Length of table travel 18 in.; cross saddle travel 6¾ in.; dimensions of table 46x8 in.; working surface, 18x6 in.; standard wheel size 7x½x-¼-in. hole; vertical movement of wheel spindle, 9 in.; maximum distance from standard wheel to table, 9 in.; overall floor space, 66x41 in.; net weight, 1,400 lbs.

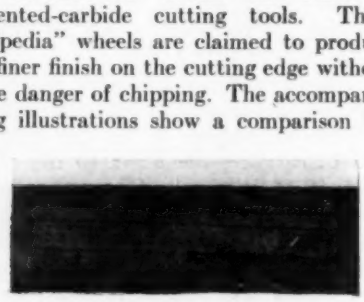
The Ex-Cell-O high speed ball bearing spindle attachment, which fits over the front part of the spindle housing, can be furnished. A pulley replaces the regular wheel and guard, this pulley being mounted on the regular grinder spindle and driving the high speed spindle. Speeds to 18,000 r.p.m. can be secured. The bracket for holding the high speed spindle clamps in any radial position on the main spindle.



A roller chain and sprocket effect table traverse of the Monarch No. 2 Precision Toolroom Surface Grinder. Forced-feed lubrication protects all bearings except those of the specially lubricated spindle. Table working surface, 18 x 6 in.; maximum distance from wheel to table, 9 in.

"Spedia" Lapping Wheels

Thomas Prosser & Son, 15 Gold St., New York, N. Y., are now representing A. C. Wickman, Ltd., England, for "Spedia" lapping wheels and hand laps, to be used for "Widia" and other cemented-carbide cutting tools. These "Spedia" wheels are claimed to produce a finer finish on the cutting edge without the danger of chipping. The accompanying illustrations show a comparison between the edge produced by an ordinary finish grinding wheel and that obtained by a "Spedia" lapping wheel.



Above—Tool edge lapped with "Spedia" lapping wheel. Below—Edge produced with finish-grinding wheel

"Spedia" wheels are stocked in cup form in the standard size, 3 in. in diameter by ⅞ in. deep, by ½ in. hole, by ⅜ in. rim. These wheels should be run at approximately 6,000 surface ft. per min.

"Spedia" hand laps can be used for finishing new tools such as "Widia" reamer blades, end mills, milling cutters, and for retouching tool set-ups in the machine.

Armco 17 and 18-8 Stainless Steels

The American Rolling Mill Co. Middletown, Ohio, is now manufacturing and distributing stainless steel sheets, strips and plates, the experimental work having been in process for some time. The steels are offered in two grades, Armco 17 and Armco 18-8. The 17 grade is used for automobile parts, furnace parts, nitric acid and oil refining equipment and oil burner parts. The 18-8 is widely used for airplane parts, baking, laundry and dairy machinery, beer barrels, hotel, restaurant and kitchen equipment, cooking utensils and a number of other uses. Stocks in all sizes and gages have been built up.

Streine Continuous-Hold-down Conveyor-Type Slitting Shear

A continuous-holddown, conveyor-type slitting shear is now being marketed by the Streine Tool & Mfg. Co., New Bremen, Ohio. This machine will handle sheets 38, 50, 62 or 75 in. in width and is designed for four sizes of cutters, 8, 12, 15 and 20 in. in diameter. For feeding sheets into the slitter, a ball bearing roller feed table with a quickly adjustable side gage is available.

The sheet passes between two tracks of a conveyor on which are mounted half-oval slats made of either bakelite or steel depending on the material. Spring pressure urges the two tracks together so that the sheet is held firmly as it is being fed through. The rear conveyor can be racked back and the left housing moved outwardly by a rapid-acting screw to facilitate the changing of cutters. Provision is made so that the axes of the cutter shafts are always parallel. Anti-friction bearings support the cutter arbors, being mounted in eccentric sleeves and adjusted vertically by means of a worm and gear.

A scrap cutter is designed for use in connection with this machine, consisting of four rotating blades which sever the strip as it passes over an anvil roller. Eccentric tool-steel bushings are inserted between the shaft and the anvil roller so that the cutter will operate regardless of the thickness of stock.

Graham Emery Wheel Dresser Holders

Two styles of emery wheel dresser holders for use on common and special grinders having tables, flat surfaces, or suitable places to take them, are now available from the Graham Mfg. Co., 71 Willard Ave., Providence, R. I. Fig. 1 shows the long-base type. Fig. 2 shows a square base type. Both styles

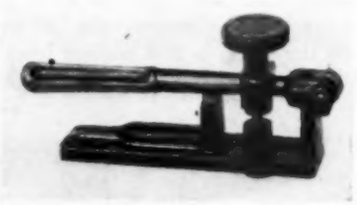


Fig. 1—Graham Long-Base Dresser Holder with Huntington Dresser in place. The base is 9 in. long

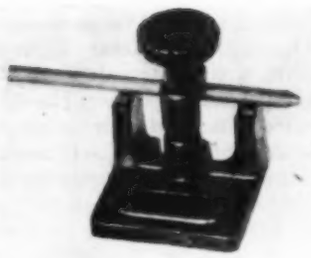
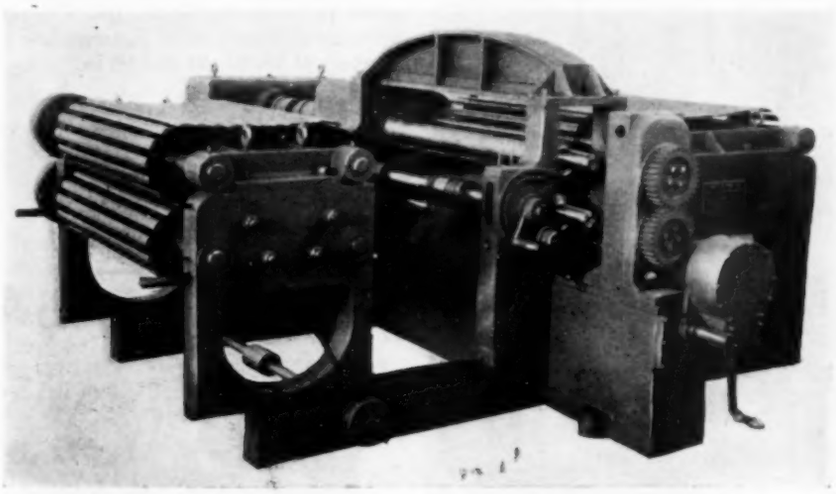


Fig. 2—Round diamond dresser in place on Graham Square-Base Dresser Holder

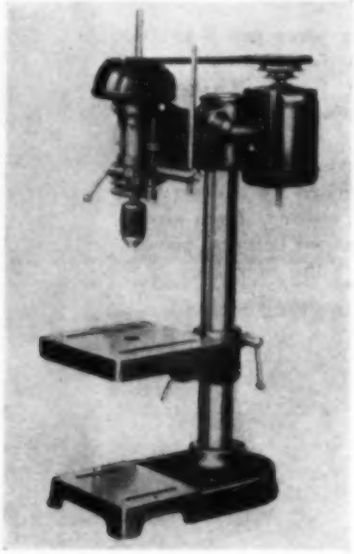
are arranged with bolt slots for attaching to the table of the machine. The tops of the upright projections on the holder, where the dresser handle comes in contact, are V-shaped to accommodate "Huntington" handles or to take ordinary round shanks. A hook washer secured by a knob and screw holds the dresser handle in place. The design brings the center of ordinary dresser cutters approximately 3 in. above the surface of the table. The square type is 4¼ in. square with cross and lug slots suitable for ⅝ in. bolts. The long type is 2 in. wide by 9 in. long.

Delta Bench-Type Sensitive Drilling Machine

The Delta Mfg. Co., 3775 N. Holton St., Milwaukee, Wis., is now introducing a bench-type drill press having overall dimensions of 36½ in. high; 10 in. wide, and 21 in. from front to rear with motor installed. The spindle runs in New Departure ball bearings and is of the free-floating type. It is fitted with a "Delta-Grip" chuck of the self-tightening type, having a capacity for 17/32 in. drills. Interchangeable spindles are avail-



Sheets of 38, 50, 62 and 75 in. in width can be slit on this Streine Conveyor-Type Shear, which has a scrap cutter



able, one fitted with a Jacobs chuck, one for No. 1 Morse taper-shank drills, and one for standard ½-in. shank woodworking bits. The quill is graduated and fitted with an adjustable pointer for depth drilling. It has a stop rod and adjustable stop nuts for repetition drilling. Standard spindle speeds are: 590; 1,275; 2,450 and 5,000 r.p.m. The bench base is slotted for the accommodation of work. A production-type table with a plain top surface 11x16 in. in size and with an oil trough all around is also available.

Raule Multiple-Spindle Internal Grinder

A continuous, multiple-station, rotary, internal grinder is being built by the Oakmont Mfg. Co., Vista, Calif. The illustration shows a machine with six spindles, but the number of spindles can be varied. Each spindle grinds the piece from start to finish in one pass around the machine. Speed of the machine is from 1 to 2 r.p.m. depending upon the character and amount of metal to be removed.

The machine is arranged for either automatic or manual loading. Discharge in either case is automatic. On the main body of the machine are hung the motors, wheels and slides for traverse, chucks, and gearing for revolving the chucks. In the course of the revolution, the motors and wheels are traversed vertically and fed horizontally into the work. Electrical current for the motors is applied from overhead trolleys. For slow-speed grinding operations the electrical supply is of 60 cycles, but when high wheel speeds are required high-cycle current is necessary. The wheel is mounted directly upon the motor shaft. Chucks are driven by gearing and operated by cams to grip, release and change speed. Discharge and sweep-off are accomplished by cam action.

Operation of the machine is as follows: The piece is set into the machine, the chuck is closed by a cam as the machine advances, and the motor descends in the traverse position. If the piece has been improperly chucked, the motor and wheel remain at the elevated position because of a safety hold-out. When conditions are satisfactory the chuck starts to revolve and the wheel to feed into the work. The wheel is fed into grinding contact, and grinding continues until the work piece has reached the desired size, at which point the wheel is first pushed from the work and then withdrawn from the bore. This action prevents bell-mounting. Wheel speed and chuck speed are then changed, and the wheel again descends into the bore and the polishing or finishing operation is completed. At each cycle, the wheel is fed out slightly and resized before starting on a new piece. When the wheel becomes too small the motor is held automatically in the upper position. A piece is turned out finished every 5 to 10 sec. but the actual grinding time on these pieces ranges from 22 to 45 sec. depending upon the setting of the machine.

One piece per 5 to 10 sec. is obtained from the Raule Multiple-Station Internal Grinder. A safety hold-out prevents improperly chucked work from being ground. Each piece is gaged before it leaves the machine

"Ajax" Pneumatic, Multiple-Disk Friction Clutch

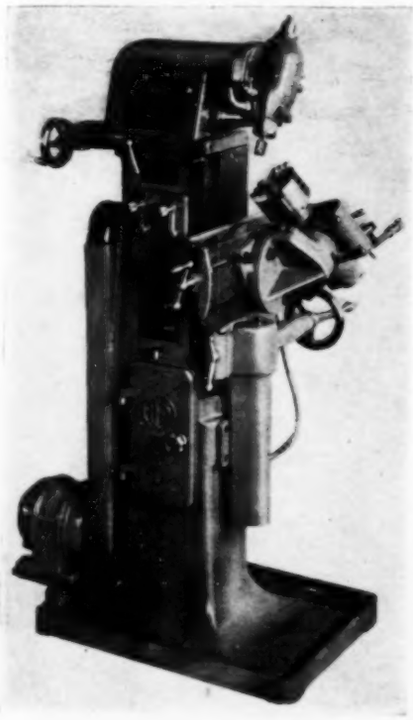
A line of quick-acting, pneumatically operated clutches for use on forging machines, presses, bulldozers and similar equipment has been announced by the Ajax Mfg. Co., Euclid Branch P. O., Cleveland, Ohio. These clutches are built in capacities from 100 to 1,000 hp. per 100 r.p.m. Pressure is applied to the friction surfaces by introducing compressed air behind an annular piston acting directly upon the plates. Compression springs retract the piston and disengage the plates when the air pressure is released. Air consumption is small because of the low volume of the cylinder above the piston and the short piston stroke, ⅛ in. on four-surface, and $\frac{3}{16}$ in. on six-surface clutches.

The flywheel and its driving parts are carried upon anti-friction bearings. Driving disks are of alloy cast iron and have machine cut teeth around the outer edge meshing with an internally toothed driving ring bolted into the flywheel or clutch housing. Adjustment to compensate for wear of the friction surfaces is provided by means of six self-locking screw plugs on the inner side. Clutches are manufactured with friction-plate diameters of 18, 21, 24 and 30 in.

"Deckel" Motor Driven Universal Tool Milling Machine

Index Machinery Corp., 49 Central Ave., Cincinnati, Ohio, is now distributing the "Deckel" milling machine in a motor-driven type. The vertical milling head is mounted in the same bearing as that used by the prism-shaped overhanging arm, and the drive for the vertical head is through a gear directly from the center of the main horizontal spindle. With the vertical head in place the machine has the appearance of a conventional type of vertical milling machine. It will do both horizontal and vertical work.

The universal horizontal table swivels in four directions. The dividing head



may be mounted in the horizontal or vertical positions, and because of the flexibility of the universal horizontal table almost every angle or position can be obtained. This feature is useful in the milling of punches, dies or molds that can be held in a chuck on the dividing head.

The dividing head is arranged for direct or indirect dividing that is, direct through a 12-division index plate and a dial graduated in degrees, or indirect through three regulation index plates. In addition, the dividing head is equipped with an overhanging arm or arbor support for use when milling reamers, taps and gears. Special equipment such as a circular table, universal vise, measuring stops, punch milling attachment and copying attachment can be supplied.

Automatic feeds and six changes are provided for both the vertical and horizontal movements. The vertical head spindle and the dividing spindle are bored for No. 4 Morse taper, the same as for the main horizontal sprindle. Three spindles are equipped with adapters for use of spring collets. Working surface of horizontal table is 10½x18 in. When using the standard prism-shaped arbor support, a 5-in. cutter may be used for horizontal milling.

Sundstrand Three-Wheel Tool Grinder

Flexibility in a grinder for sharpening tools is secured by the Sundstrand Machine Tool Co., Rockford, Ill., by providing three wheels, two of which have variable speeds. With the first speed combination, one spindle has a speed suitable for grinding high-speed steel tools, the second spindle, for grinding cemented carbides, and the third spindle, for honing. With the second speed combination the speed of both the first and second spindles is suitable for grinding tungsten carbides. For the third speed combination the speed of the first two spindles is suitable for grinding high-speed steel. With any of the three speed combinations the third spindle runs always at the same speed and is equipped with a cast-iron disk.

The catch basin at each wheel contains a machined and protected mounting for adjustable work tables. Each grinding table has a T-slot for clamping of tools to grind any face or edge at any angle. Two 10-in. cup wheels are furnished. The disk for honing is 8 in. in diameter and is impregnated with diamond dust. The grinding tables are adjustable above and below horizontal to 40 deg.

Maximum flexibility in sharpening high-speed and carbide tools is afforded on the Sundstrand Three-Wheel Grinder. Two spindles can be driven singly or together for either material. The third spindle is for honing

Improvements for "High Speed" Riveting Hammers

The High Speed Hammer Company, Inc., Rochester, N. Y., has made several improvements for its riveting hammers, but a new model has not been offered. The company has the policy of making all improvements interchangeable with parts on previous models, when possible, so that users of these hammers can apply the improvements without throwing out the older models.

One of the improvements, Fig. 1, pertains to the design and assembly of the rubber cushion *A*, which is interposed between the front end of the hickory helve *B* and the reciprocating ram or hammer *C*. Previously the rubber

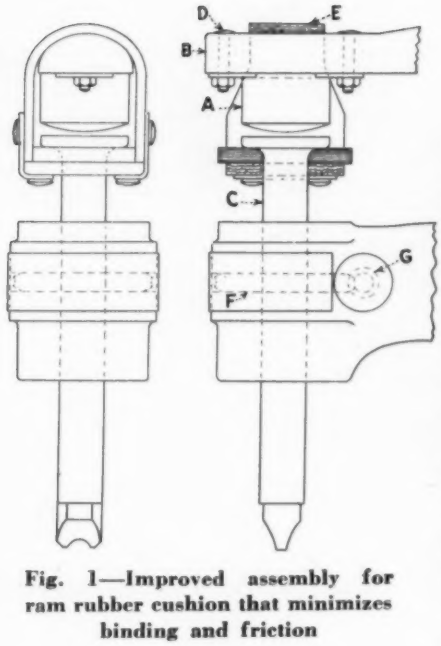


Fig. 1—Improved assembly for ram rubber cushion that minimizes binding and friction

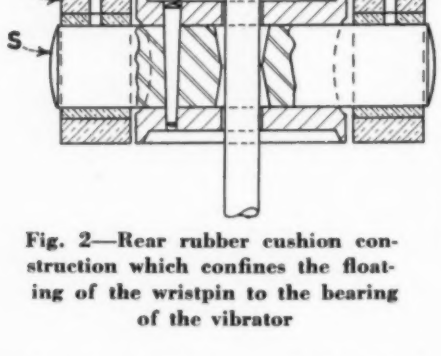


Fig. 2—Rear rubber cushion construction which confines the floating of the wristpin to the bearing of the vibrator

cushion was held between the helve and ram in a manner that required a relatively tight assembly and the use of a rubber cushion of tubular construction which had a tendency to float during action. The present design secures the rubber cushion rigidly to the underside of the helve. Friction and impact incident to striking the reciprocating ram are confined to the lower face of the rubber cushion. Furthermore, critical adjustments on the resilient strap which holds the ram or hammer in assembly with the helve are not required. Finally, the binding action of the ram has been eliminated so that it can rotate freely.

Fig. 2 shows the improved design of the rubber cushion at the rear. It consists of a center rubber retainer *M*, made in one part, which is doweled by pin *P* through wristpin *S*. This construction eliminates the floating of the wristpin in the center rubber retainer and holds these two parts in a constant relative position and confines the floating of the wristpin to the bearing of vibrator *T*.

Reinecker Universal Tool Grinder

A Reinecker universal tool grinder equipped with hydraulic table motion and an automatic hydraulic dividing head has been placed on the market in the United States by the George Scherr Co., 128 Lafayette St., New York, N. Y. This machine is designed for the automatic sharpening of tools, especially cutters for spur gears, worm wheels, cylindrical and profiled cutters and tools with straight or spiral grooves. Its range of application can be extended to include cylindrical, internal, face and surface grinding by special supplementary attachments.

The grinding head swivels 360 deg. and is arranged on a column with height and cross adjustments. A truing device for the wheel is fixed to the head.

The table moves on V and flat ways and is made in two parts. For cylindrical and internal grinding of tapered work the upper table is made to swivel on the lower table. Table movement takes place through a hydraulically driven piston and can be regulated through a throttle valve. The table can also be moved by handwheel.

The hydraulic dividing head is arranged with automatic spacing and adjustable feed-in motion. Movement of the spiral is obtained by a pinion and unrolling rack. By means of change gears it is possible to grind an angle of lead up to 65 deg. with stocking cutters. Indexing is carried out by hardened and ground index-plates, interchangeable and screwed on the indexing spindle. Automatic spacing from groove to groove takes place after each stroke of the table. In this operation an hydraulic locking device causes instantaneous stopping of the table in the case of indexing errors. The play existing in the ratio gears for the spiral motion is compensated automatically through the hydraulic adjustment of the unrolling rack at each table reversal.

Attachments available for this machine include: taper attachment, external grinding attachment, open steady rest, internal grinding attachment, closed steady rest, face grinding attachment, surface grinding attachment, and dust removing and wet grinding attachments.

Specifications: length admitted with automatic dividing head: 625 mm., without dividing head and auxiliary tailstock, 850 mm., height of centers, 125 mm., greatest diameter of piece to be ground, 245 mm.; Table: feed range, 0.1 to 8 m. per min., greatest table movement, automatic or by hand, 900 mm.; inclination of upper table, up to 8 deg.; Grinding head, adjustment in height, 225 mm., transverse movement, 175 mm.; Automatic hydraulic dividing head grinds leads from 200 to 6000 mm., divisions 2 to 40.

An automatic hydraulic dividing head on the Reinecker Universal Tool Grinder compensates automatically at each table reversal for play in the ratio gears governing the spiral motion so that the machine grinds uniformly at each stroke

"Skin-Gard" Hand Protecting Cream

The Magnus Chemical Co., Garwood, N. J., is now manufacturing "Skin-Gard," a cream which when rubbed upon the skin is quickly absorbed and forms a dry invisible protective film that prevents the pores of the skin from becoming clogged with grime. It is antiseptic. When a mechanic finishes a day's work the "Skin-Gard" is removed readily with water and all dirt and grease is removed.

Ex-Cell-O Motor-Driven Spindle for Monarch No. 2 Surface Grinder

The Ex-Cell-O Aircraft & Tool Corp., 1200 Oakman Blvd., Detroit, Mich., has developed an inbuilt, direct-motor-driven spindle as standard equipment for the Monarch No. 2 surface grinder described elsewhere in these pages. Both spindle and motor are inclosed in a common body, and the spindle is equipped with two Ex-Cell-O precision ball bearings. A water guard on the front end of the spindle provides protection from water, dirt and other foreign material.

The motor is rated at 1 hp., 3,500 r.p.m., on 60-cycle, three-phase, 220-, 440- or 550-volt current. By mounting the spindle and motor on the same shaft and in one body, a compact and rigid unit is obtained, permitting heavier cuts and better finishes.

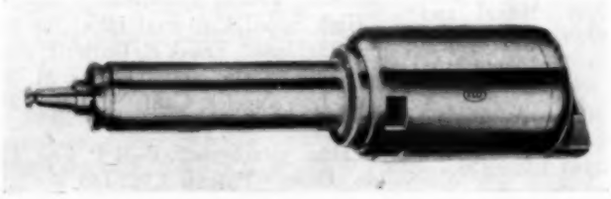
Acme Tee-Welding Attachment

A Tee-welding attachment that may be used on spot welders has been developed by the Acme Electric Welding Co. 5621-23 Pacific Blvd., Huntington Park, Calif. One attachment is used on the lower horn of a spot welder for Tee welding, while for performing butt-welding operations, two attachments are employed, one on the lower horn and one on the upper horn. They are of particular interest to wire workers, such as manufacturers of refrigerator shelves, stove shelves, bird cages and allied products.

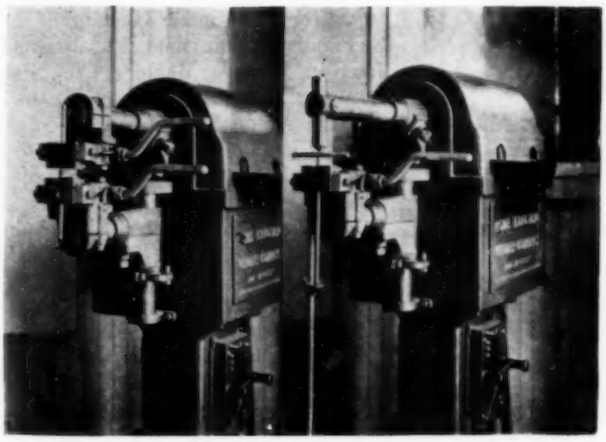
The attachment is constructed of tough bronze with solid copper reversible and replaceable die-blocks. All of the movable, wearing parts such as the pivot stud, cam and cam face plate, are of hardened steel. The jaws take any size wire from No. 16 gage up to ½ in. in diameter, being adjusted by a thumb screw. The jaws are actuated by a cam on the offset handle. Parts are made reversible so that the attachment may be operated either right- or left-handed.

Olsen Style L Automatic-Weighing, Static-Balancing Machine

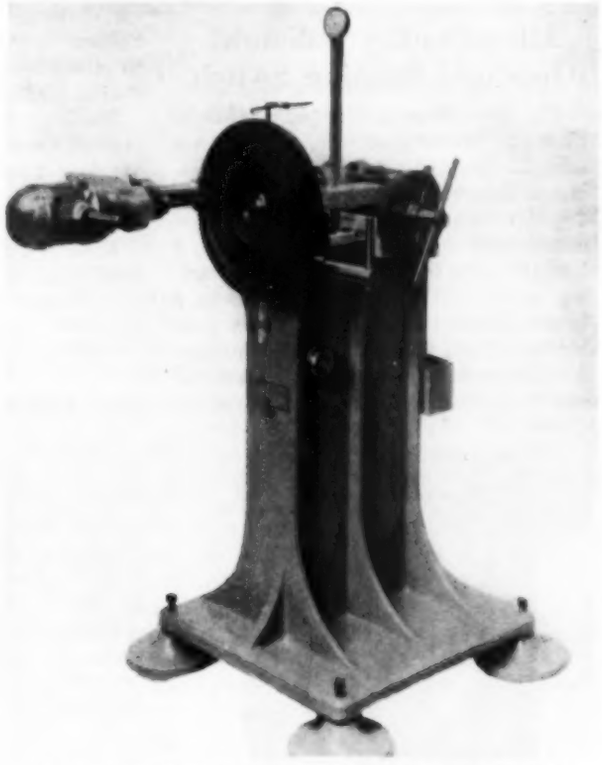
Flywheels, clutch parts and assemblies can be statically balanced on the Style L automatic-weighing, static-balancing machine developed by the Tinius Olsen Testing Machine Co., 500 No. 12th St., Philadelphia, Pa. The part to be balanced is mounted on an adapter fitted to the spindle of the machine, with the weighing system locked in position. The locking system is then released and the reading on the indicator at the top of the machine noted, and the part to be balanced turned on its mounting with the weighing system locked until a point is reached where the dial indicates zero. At this stage the pointer at the top of the flywheel indicates the exact angle of unbalance. The part to be balanced is now turned 90 deg., the weighing system released, and the pointer on the indicator will show the amount of static unbalance. The dial indicator may be set so that the markings will indicate either the amount of unbalance in the range desired in ounce-inches to be removed or added, or in any other system as preferred. The machines are built in six sizes to take parts weighing from 2 to 15 lb. in the smallest size to 2,500 to 20,000 lb. in the largest size.



Ex-Cell-O Inbuilt, Motor-Driven Spindle for Monarch No. 2 Surface Grinder. The motor is rated at 1 hp., 3,500 r.p.m.



Left—Spot welder equipped with two Acme Tee-Welding Attachments for butt welding. Right—A single attachment is used for plain tee welding



An electric drill is mounted on the Olsen Style L Automatic-Weighing, Static-Balancing Machine for correction on a production basis

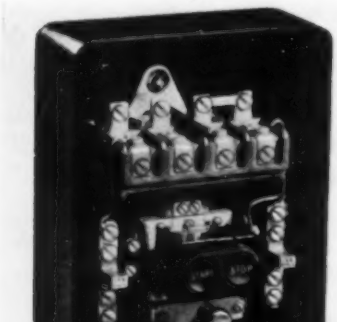
"Junior" Electric Solder and Melting Pot

Closely maintained operating temperature, better heat distribution and full insulation are among the features of the "Junior" electric solder and melting pot now being built by the Newton Junior Corp., 151 Court Street, New Haven, Conn. This pot is suitable for tinning and dipping and for hardening small tools and will keep in a molten

condition all metals or materials with melting points as high as those of tin and solder. When filled to capacity the melting period of the pot is about 20 minutes. Power consumption at maximum capacity is 275 watts. Molten metal cannot enter the heating chamber, and the terminals are guarded from overflow or dripping metal. Pot capacity is 4 lb.

Allen-Bradley Solenoid-Operated Starting Switch

The Allen-Bradley Company, 1311 S. First St., Milwaukee, Wis., now offers a solenoid-operated, across-the-line starting switch rated at 5 hp. 220 volts; 7½ hp., 440-550 volts for polyphase motors and up to 1½ hp., 110 volts; 3 hp., 220 volts for single-phase, self-starting motors. The switch is made in 3 forms: Form 1 has start and stop push buttons, Form 2 is without push buttons for thermostat or remote pilot control and Form 3 has a 2-way, hand-automatic



switch for try-out control installations. The switch is small in size and an arc hood suppresses the arc. A full-floating mounting prevents machine vibrations from interfering with the operation of the switch.

• PATENTS •

OCTOBER 3, 1933

Metal-Working Machinery

Spindle Guide Bracket. David C. Klausmeyer, Cincinnati, Ohio, assigned to the Cincinnati Bickford Tool Co. Patent 1,928,756.

Machine for Chamfering Gears. Richard Max Uhlmann, Philadelphia, and John Arthur Maywhort, Cheltenham, Pa., assigned to the Bilgram Machine Works, Inc. Patent 1,928,770.

Indexing Mechanism for Multiple-Spindle Machines. John P. Brophy, Cleveland, Ohio, assigned to the Cleveland Automatic Machine Co. Patent 1,928,925.

Feed Mechanism for Machine Tools. Walter Ferris, Milwaukee, Wis., assigned to the Oilgear Co. Patent 1,929,185.

Cross Feeding Mechanism for Grinding Machines. Peter Plantinga, Greenfield, Mass., assigned to Greenfield Tap & Die Corp. Patent 1,929,214.

Apparatus for Automatic Form Turning Lathes. Clifford A. Bickel and Philber A. Abe, Sidney, Ohio, assigned to the Monarch Machine Tool Co. Patent 1,929,269.

Machine Tool. Clifford A. Bickel, Sidney, Ohio, assigned to the Monarch Machine Tool Co. Patent 1,929,270.

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OCTOBER 10, 1933

Metal-Working Machinery

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Gauge Mechanism for Grinding Machines and the Like. Harold L. Blood, Worcester, Mass., assigned to The Heald Machine Co. Patent 1,929,966.

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OCTOBER 17, 1933

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OCTOBER 24, 1933

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